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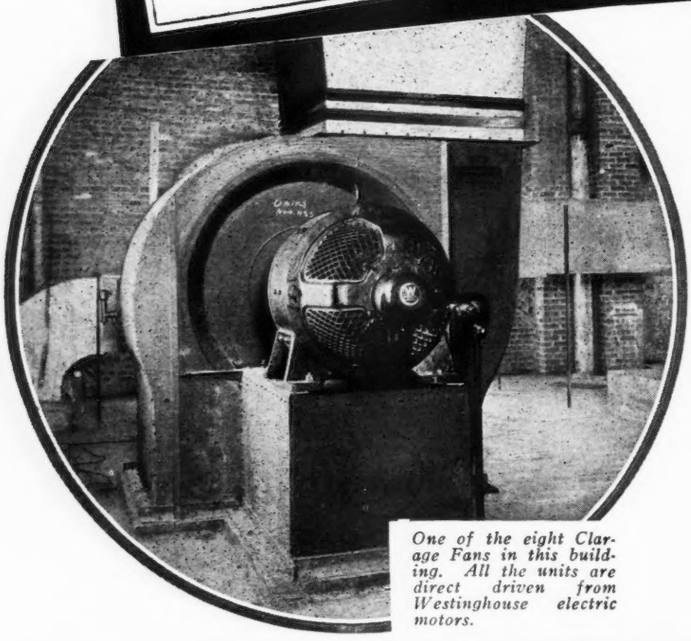

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NOVEMBER, 1924

Another Central Heating System Turns to Live Steam

Details of 1924 Construction Program of the Union Electric Light and Power Company, St. Louis, Which is Substituting High Pressure Steam Operation From a Central Plant for Isolated and Interconnected Plant Service

By L. E. Young

Manager, Steam Heating Department, Union Electric Light and Power Company, St. Louis

FOR many years the economic advantages of central station heating have been presented in the heating and other technical publications; however, the general public does not realize that central station heating antedates the development of central station lighting by a number of years (Bushnell and Orr, "District Heating," p. 2). During the forty years since 1878, when the first central station heating was done at Lockport, New York, there was a slow but substantial development of the business. With the rapid increase in the cost of coal and other commodities, and on account of the serious problem of traffic congestion in the cities, there has been in recent years a marked growth in the steam heating business.

Steam and electrical engineers have given the heating and electric problems of the large cities the most painstaking consideration and the developments of the past decade in New York, Detroit, Pittsburgh, Boston, Milwaukee, Dayton, Cleveland, St. Louis, and other large cities demonstrate a general agreement upon the plan of supplying live steam for heating as a utility, independent of and separate from the plant operations for electric generation.

WHY LIVE STEAM DISTRIBUTION IS THE MOST PRACTICAL METHOD

Unfortunately the steam requirements for heating buildings are greatest when the electric lighting and power load is least and the lighting and power load is greatest during those hours of the day when the steam heating peak has passed; therefore, exhaust steam from electric generating units is generally not available at the time and in quantities necessary for supplying fully the heating requirements of buildings. It has been the experience of a number of the public utility companies that have been supplying steam for heating buildings in the business section of our largest cities,—particularly in the older cities having narrow streets,—that the most practical and economical system is to supply live steam for distribution through mains, thus making the steam service independent of the operation of electric prime movers.

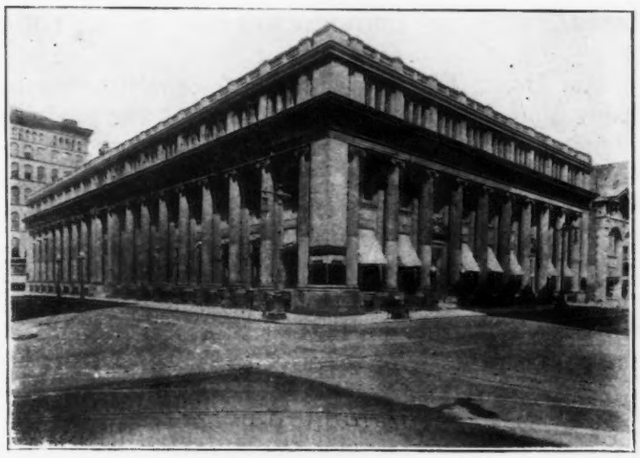

Fig. 1—Mercantile Trust Building, St. Louis

A prominent banking institution from which the independent boilers were removed after central station heating service could be supplied.

The 1924 construction program of the steam heating department of the Union Electric Light and

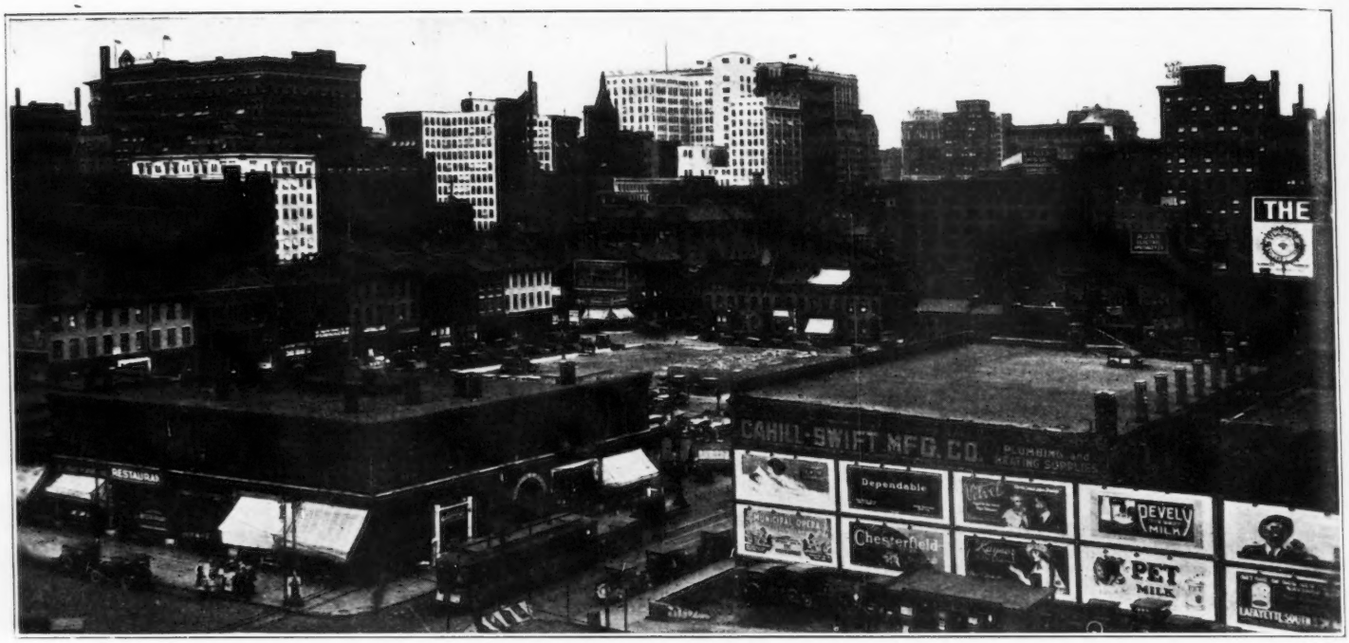

Fig. 2—Skyline of St. Louis

Power Company is a result of the consistent growth of the steam heating business in St. Louis and of the fact that the management has satisfied itself that the operation of isolated and interconnected steam plants cannot be justified economically if steam can be supplied from a central plant or a plant on a railroad within a reasonable distance of the center of distribution.

DEVELOPMENT OF DISTRICT HEATING IN ST. LOUIS

The Union Electric Light and Power Company has supplied steam to a large part of the business district of St. Louis for a number of years. Prior to 1916 the service was supplied largely from block plants which had been leased. With the installation of new boilers in the Tenth and St. Charles Streets plant the company really took the first step toward creating a distribution system, as high-pressure mains were then laid so that steam could be distributed at 175 lbs. pressure.

All of the steam supplied from this plant has been live steam. On several occasions the company has considered carefully the advisability of distributing exhaust steam through a low-pressure system to be built and of installing electric generating units at the Tenth Street plant but has determined each time that the proposed plan was not feasible after taking in account (1) capital investment in generating equipment and a system of steam mains large enough to distribute the volume of exhaust steam required for heating purposes, and (2) the cost of generating electricity at Tenth Street as compared with the cost at which energy can be supplied from other sources.

Each year since 1918 the high-pressure mains have been extended and in 1923 the total length of mains was about 4½ miles. The load on the Tenth Street plant has been increased as new business has been acquired and as isolated plants have been connected to the system. Some of these isolated steam plants have contained electric generating equipment and it was proposed that these plants should be operated as electric plants during the heating season at such times as the exhaust from the engines could be taken into the heating

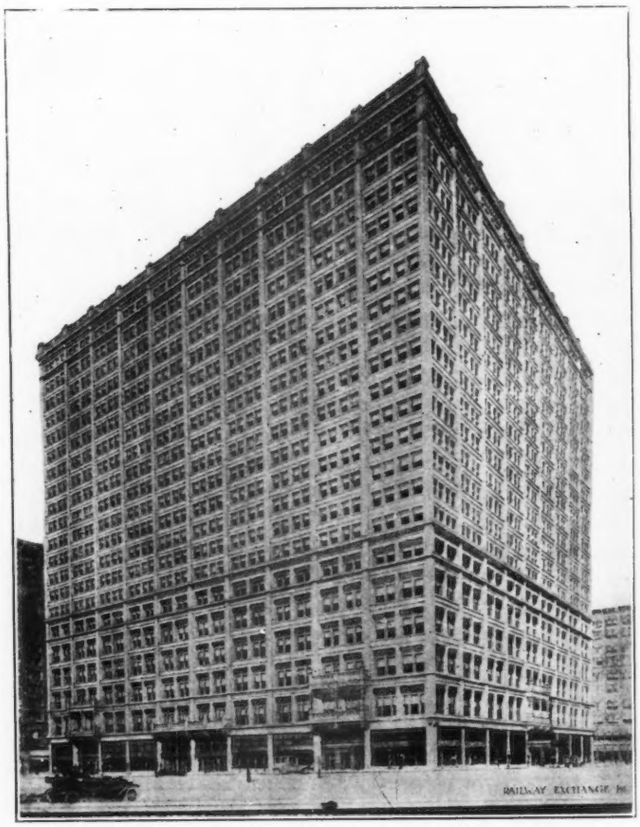

Fig. 3—Railway Exchange Building in the Commercial District of St. Louis

Containing 260,000 sq. ft. of radiation and heated with central station steam.

system. It was found after operation under this plan that the cost of both the electricity and the steam generated in these plants was higher than from the company's lines and mains, largely due to the fact, as stated, that the heating and electric peaks do not occur at the same time. This excess in cost of production was found to occur in the case of leased electric plants on which the company paid no annual rental and for which, therefore, there were no charges for interest, depreciation and taxes.

CLASSES OF BUILDINGS ESPECIALLY ADAPTED TO CENTRAL HEAT SERVICE

New business comes to the company from (a) new buildings in which, on account of the availability of steam from the company's mains, no boilers are being installed; (b) old buildings in which the boilers and generating plant are depreciating or becoming obsolescent; (c) buildings from which boiler plants are being removed in order to release space for other purposes, and (d) buildings whose owners have realized that it is more economical to purchase steam than to produce it in small boiler plants.

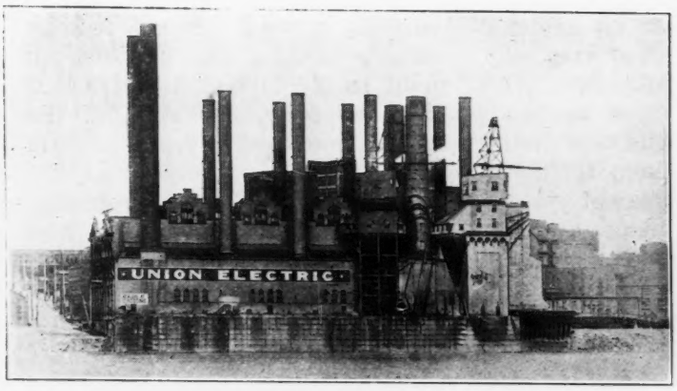

Fig. 4—Ashley Street Plant, St. Louis, Now Being Connected to Steam Distribution System of Union Electric Company

This plant contains 56 boilers and is located on the Mississippi River with railroad connections.

INCREASED BOILER CAPACITY FOUND NECESSARY

In 1923 the total steam load connected to the Tenth Street system exceeded the boiler capacity of the Tenth Street plant and it was necessary during severe weather to operate several of the plants that have been connected with the system. With the additional business contracted for 1924 and 1925, it was obvious that other means for carrying the load would have to be devised. One of

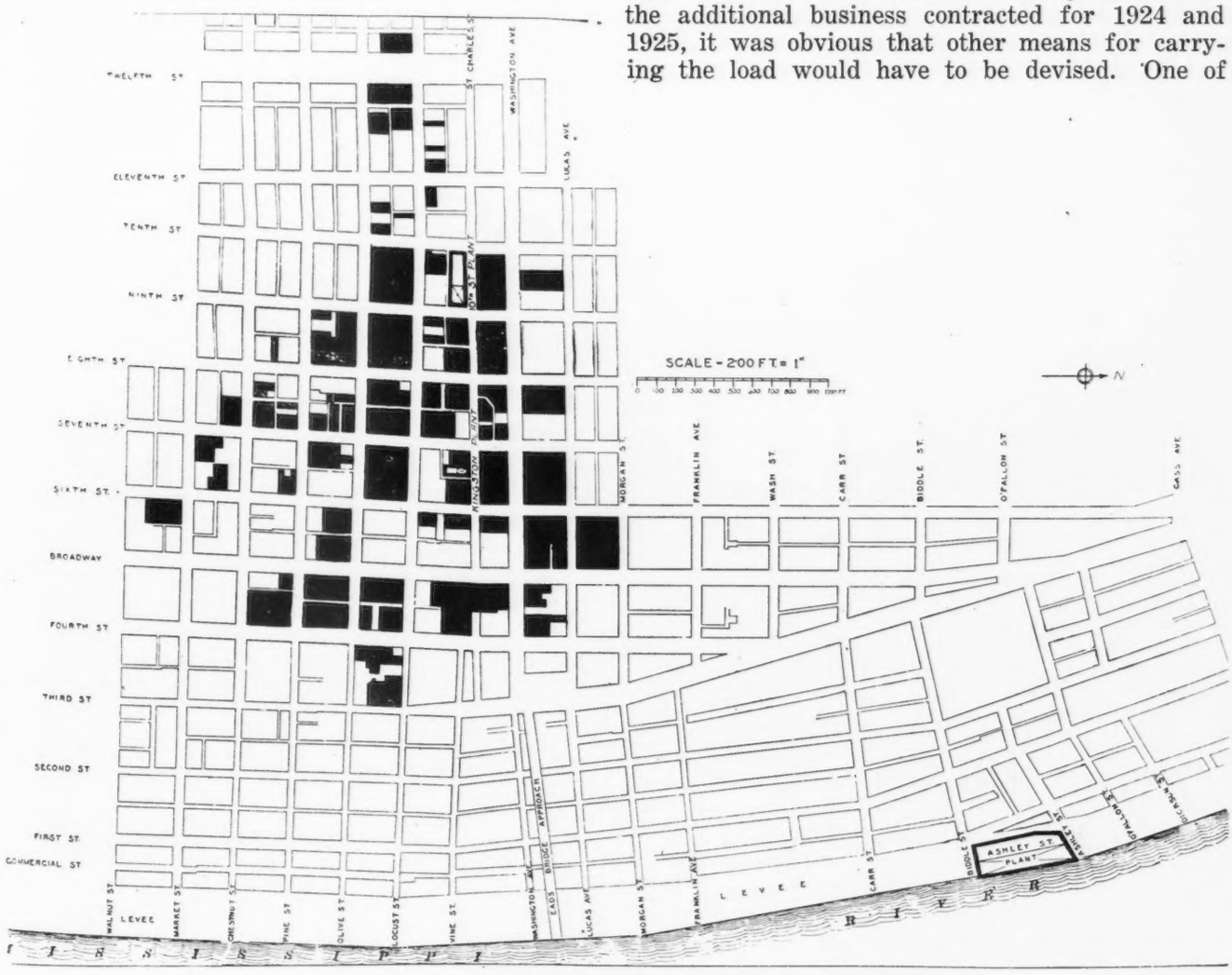

Fig. 5—Map of Steam Heating District of St. Louis

Shaded areas denote buildings heated from central heating plant.

several alternatives was possible, namely: (1) Operating more standby plants, (2) building an additional boiler plant in the business district or on a railroad within reasonable distance of the business district, or (3) constructing a steam main from the Ashley Street plant to connect with the present system of steam mains. The last plan was adopted and the construction program is now well under way.

THE ASHLEY STREET PLANT

The Ashley Street plant is located on the Mississippi River and is the most important plant operated by the Union company in St. Louis. It contains 56 boilers, with an aggregate nominal rating of 30,000 H. P. A careful study has been made of the seasonal and daily electric load curves, both for the system and for the Ashley Street plant, together with the seasonal and daily load curves of the steam heating system. As the heating load in St. Louis is generally a forenoon load, it was agreed that the load factor of the Ashley Street plant would be improved greatly if live steam could be supplied to the heating system.

In order to connect with the present steam system the company is now installing a total of 7,600 ft. of mains, including 3,700 ft. of 20-in., 1,245 ft. of 16-in., 495 ft. of 14-in., 1,295 ft. of 12-in., and 910 ft. of 10-in. piping. Several runs of smaller pipe are being laid which will make it possible to discontinue the operation of five steam plants that were operated continuously in 1923. This will make a total of 30 boiler plants ranging in capacity from 175 to 500 H. P. which have been closed down since 1916 in addition to more than 75 smaller low-pressure plants.

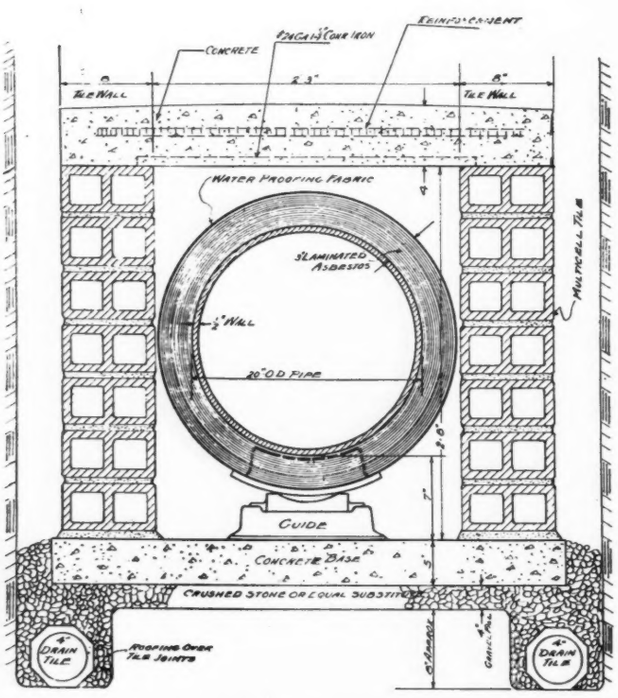

Fig. 6—Section of 20-In. Steam Main, Showing Character of Construction

CONSTRUCTION FEATURES OF MAINS

The mains are built of extra-strong steel pipe, insulated with 3-in. of high-grade asbestos covering, laid in conduit. The conduit has a concrete base laid on gravel with underdrain tile; the side walls are multicell tile and the top is a slab of reinforced concrete. The steel pipe is butt-welded and four reinforcing steel straps, 3-in. wide by ½-in. thick by 12-in. long are welded longitudinally across the butt weld. The line is being built for 250-lbs. steam pressure, with 100° F. superheat. Upon the completion of this main, steam will travel a maximum of 8,100 ft. from the Ashley Street plant to the most remote steam customer now served from the system. The 20-in. main now being laid will have an ultimate capacity of double the present load of the system.

EFFECT IN REDUCING SMOKE AND TRAFFIC CONGESTION IN BUSINESS DISTRICT

As a result of this present construction program, the smoke in the business district will be reduced somewhat, as it will make it possible to discontinue the operation of hand-fired boilers in several of the standby plants as well as those in buildings now contracting for service. The streets will be less congested with coal and ash trucks as the uptown plants of the company have burned nearly 75,000 tons of coal annually.

Most of the new buildings being erected in the business district do not have boiler plants because dependable steam service can be purchased at a fair price; 60% of the customers that will be supplied with steam from the Ashley Street plant do not have boilers on their premises. It is interesting to note that every bank and every department store in the business district secures steam from the Union company.

Steam is supplied for a variety of purposes, in addition to the heating of space and water, such as cooking, laundry, clothes-pressing and cleaning and printing. Service is supplied to many types of buildings, including office buildings, hotels, clubs, banks, department stores, restaurants, theatres, picture shows, printing plants, manufacturing plants, and general mercantile establishments.

For a number of years several of the leading newspapers of St. Louis have depended solely upon the Union company for steam for printing papers. The printing of a daily newspaper on a schedule to match the schedule of the mail and the railroad service is a marked proof of the dependability of the steam heating utility now serving most of our large cities.

The fact that steam service is being supplied is not realized by a large number of those who are familiar with such public utilities as electricity, gas and water. The demand for steam service is growing rapidly and when the general public understand that it is possible to purchase steam the same as it is possible to contract for electricity, gas, and water, the demand will undoubtedly be as universal as is the demand for central station electricity.

The Insulation of Roofs to Prevent Heat Loss and Condensation

With Notes Showing How to Figure This Work and the Savings Made Possible When Effective Insulation is Applied

By W. L. Miller
Vice-president and General Manager, Union Fibre Company, Inc.

I. Prevention of Heat Loss

WITH the rising cost of heating, the insulation of roofs to prevent heat loss and condensation is gaining a new significance in the work of the heating engineer. When it is considered that the savings possible in this way alone may easily amount to 10% of the total cost of heating, it can be seen how important this factor can become in the design of a heating system, especially for the larger types of mills, factories and similar buildings having extensive roof surfaces.

Insulation plays an important part, not only in reducing heat losses, but in the equally important matter of preventing condensation. Condensation may be prevented in three ways: (1) by lowering the amount of moisture in the air through mechanical ventilation (2) by insulating the roof so that its resistance to the transmission of heat is increased to a point where the temperature of the inside roof surface will not fall below the dew-point, or temperature of condensation, of the moisture-laden air in the building, and (3) by both, when the humidity of the inside air is extremely high.

In figuring this work, it is necessary to bear in mind that heat reaches the roof both by radiation and convection, also that the temperature of the roof surface and the air in contact with it are not the same. This difference in temperature occurs within a thin layer, or film, of air very close to the surface.

In cases where new buildings are being designed it is, of course, impossible to measure the difference in temperature between the inside surface of the roof and the air in the building. The maximum inside operating temperature of the building, however, is always known from experience under similar conditions. The minimum outside temperature can be obtained from the weather records. Thus the difference in temperature between the inside and outside air, or the maximum "heat head" is established.

It is now necessary to know two values for the roof in question, its overall resistance, and its coefficient of heat transfer, each being the reciprocal of the other. These values have been worked out by the Union Fibre Co., Inc., of Winona, Minn., with a 5-ply tar and gravel roofing and are given in Table 1. Table 2 shows the thermal conductivity and resistance of a variety of materials used in roof construction, as compiled by the Union Fibre Company.

There are two distinct conductivities and resistances for a material (1) air-to-air conductivity, derived from tests which determine the conductivity of a material with surface constants, giving the B.T.U. transmitted through the material from air to air and (2) surface-to-surface conductivity, or internal conductivity, derived from tests which determine the number of B.T.U. transmitted through the material from surface to surface only, giving the internal conductivity.

Internal resistance of a material is directly proportional to thickness. Air-to-air or overall resistance of a material is not directly proportional to thickness. The resistance, after surface resistances are deducted, is directly proportional to thickness.

With dwellings or similar constructions with air space, it is fair and just to use air-to-air conductivity. With built-up roofs the insulation is completely sealed, one material to another, with no air spaces adjacent and it is not allowable to use air-to-air conductivities for the reason that the surface resistances are practically eliminated by the seals. All conductivities and resistances for different materials appearing in Table 2 are for surface-to-surface, or internal conductivities only.

The term "coefficient of heat transmission" is the recognized term applying to air-to-air temperatures only, and is so used herein with reference to a complete roof. It is the heat flow through the complete roof for 1° difference in temperature per hour for 1 sq. ft. of heating surface.

CALCULATIONS FOR A SIMPLE ROOF

For a simple roof, or one containing only one material, such as a metal or tile roof, where roofing material is not required, the overall resistance may be found from the following formula:

$$R = \frac{1}{K_1} + \frac{X}{C} + \frac{1}{K_2} \quad (1)$$

Where R = resistance of roof.
K_1 = inside surface coefficient.
X = thickness of the roof material in inches.
C = unit conductivity of the roof material in B.T.U. per square foot per de-

gree difference in temperature per hour, per inch thickness.

K_2 = outside surface coefficient.

C and K_1 are determined experimentally and values of these factors for various materials are taken from Table 2.

K_2 is taken as $3K_1$ for usual conditions.

The coefficient of heat transmission of the roof, or the heat transmitted through the roof, from the inside air to the outside air will be

$$\frac{1}{\text{Resistance}}$$

This coefficient will be in B.T.U. per square foot per degree difference in temperature between inside and outside air (or heat head) per hour.

Example: Find the overall resistance and coefficient for a 2-in. concrete roof, without roofing.

$K_1 = 1.3$ (from Table 2).
$X = 2$ in.
$C = 8.3$ (from Table 2).
$K_2 = 3.9$.

$$\text{Then } R = \frac{1}{1.3} + \frac{2}{8.3} + \frac{1}{3.9} =$$

$$0.769 + 0.241 + 0.256 = 1.266.$$

$$\text{Coefficient } \frac{1}{1.266} = 0.800 \text{ B.T.U. per square foot per degree difference in temperature per hour.}$$

The total heat loss through roof per hour, will be:

$H = C_r \times A \times T$

Where H = heat loss through roof in B.T.U.

C_r = coefficient of roof as determined above

A = area of roof in square feet.

T = difference in temperature between air in building and outside air, or "heat head."

COMPOUND ROOF WITHOUT AIR SPACES

It must be understood that in calculating the conductivity of a compound roof, conductivities of the various materials composing the roof cannot be added together to obtain the conductivity of the compound roof. Resistances of the various materials must be added, and the total resistance so obtained reduced to coefficient of heat transmission by the formula:

$$\text{Coefficient of heat transmission} = \frac{1}{\text{Resistance}}$$

For a compound roof, or a roof composed of two or more materials, without air spaces, the overall resistance can be found from the following formula:

$$R = \frac{1}{K_1} + \frac{X_1}{C_1} + \frac{X_2}{C} + \text{etc.} + \frac{1}{K_2} \quad (2)$$

Where K_1 = surface coefficient for the inside material.

X_1, X_2, X_3, etc. = thickness of the various materials.

C_1, C_2, C_3, etc. = unit conductivities of the various materials.

K_2 = surfaces coefficient for the outside material = 3 x coefficient K_1 for same material.

With some materials, such as hollow building tile, the unit conductivity in the table is given for the actual thickness of the material, instead of per inch thickness. In such cases the resistance given in Table 2 is used, instead of X/C.

It is well to call attention at this point to the fact that the values for heat transfer for hollow tile, of what ever composition, if only heat loss is to be considered, are correct. But if the problem is one of preventing condensation, additional insulation over that calculated should be applied if an altogether satisfactory job is to be obtained, for the following reason: A value given is the average value of a whole tile and the ordinary amount of insulation will insulate against conductivity where the air spaces in the tile occur, but at the sides of the tile and where the partitions extend through, then the heat flow will be much greater, therefore the resistance for these particular sections will be much less, and a grid of precipitation will occur immediately below where these partitions or sides extend through the roof as would be the case with precipitation covering the entire under surface if the tile were solid and not sufficient insulation applied to prevent it.

Example: Find the overall resistance and coefficient for the following roof: from outside to inside, 5-ply tar and gravel roofing, on 2-in. concrete, on 6-in. hollow tile, with ½-in. plaster on bottom of tile:

for plaster, $K_1 = 1.1$
$X_1 = 0.5$
$C_1 = 5.5$

For 6-in. hollow tile,

$$\frac{X_2}{C_2} \text{ or resistance} = 2.667 \text{ (from Table 2).}$$

For 2-in. concrete, $X_3 = 2$
$C_3 = 8.3$

For roofing,

$$\frac{X_4}{C_4} \text{ or resistance} = 0.530 \text{ (from Table 2).}$$

$K_2 = 3 \times 1.25 = 3.75$.

Substituting in Formula 2, we have

$$R = \frac{1}{1.1} + \frac{0.5}{5.5} + 2.667 + \frac{2}{8.3} + 0.530 + \frac{1}{3.75} =$$

$0.909+0.091+2.667+0.241+0.540+0.267=4.705$

Coefficient of heat transfer = 0.212 B.T.U. per square foot per degree difference in temperature per hour.

COMPOUND ROOF WITH AIR SPACE

Most designers have an exaggerated idea of the insulating value of air spaces. As a matter of fact, the only real benefit derived from an air space is that due to the surface resistance of the materials on each side of the air space. The resistance of the air space itself can be taken as 0.637. Above 6 in. in thickness no resistance should be allowed for an air space on account of convection currents set

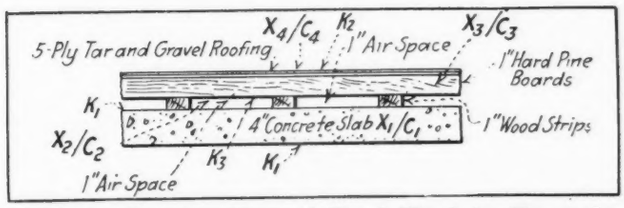

Fig. 1—Construction of Roof Used in Example

up in the air which really increases the rate of heat transfer.

In this connection A. C. Willard, professor of heating and ventilation and head of the department of mechanical engineering at the University of Illinois, has this to say: "Either use the surface coefficients alone, or the so-called conductivity of an air space alone. I much prefer the former, as in any commercial air space the air, especially if space is vertical and even when horizontal, is in more or less motion. 'Dead' air is almost unknown except in porous materials where spaces are microscopic."

An air space beneath a roof is an actual disadvantage in keeping a building cool when it is exposed to the summer sun, unless provision is made for ventilating the air space at night. The air in such a space is heated during the day to a high temperature and unless this heated air is replaced by cool air after the sun goes down, there is an actual heat reservoir in the air space, which will keep the rooms below hotter during the night than they would be otherwise. The foregoing statement applies more to air spaces containing a considerable amount of air rather than to air spaces under 12 in. in depth.

Much damage often occurs in buildings with an air space above the ceiling of the top floor, due to condensation of moisture in the air space, even when the air in the building below the ceiling may be exceedingly dry. Air of high humidity will gain entrance to the air space from outside, and a sudden drop in the outside temperature will cause condensation under the roof and above the ceiling, unless the roof above the air space has sufficient resistance to prevent sudden chilling of the air in this space. Moisture, or rather water, in the air space is often blamed to a leaking roof, whereas the water really comes from condensation in the space.

EXAMPLE: The following example will show a method of calculating the overall resistance and coefficient of the roof illustrated in Fig. 1. This roof contains an air space less than 6 in. thick.

$$R=\frac{1}{K_1}+\frac{X_1}{C_1}+\frac{1}{K_1}+\frac{X_2}{C_2}+\frac{1}{K_3}+\frac{X_3}{C_3}+\frac{X_4}{C_4}+\frac{1}{K_2} \quad (5)$$

For concrete $K_1=1.3$, $X_1=4$, $C_1=8.3$

For air space $X_2/C_2=0.637$

For hard pine $K_3=1.4$, $X_3=1$, $C_3=0.958$

For roofing $X_4/C_4=0.530$

$K_2=3\times 1.25=3.75$

$$\text{Then } R=\frac{1}{1.3}+\frac{4}{8.3}+\frac{1}{1.3}+0.637+\frac{1}{1.4}+\frac{1}{0.958}+0.530+\frac{1}{3.75}=0.769+0.482+$$

$0.769+0.637+0.714+1.043+0.530+0.267=5.211.$

Coefficient = 1/5.211 = 0.192 B.T.U. per square foot per degree difference in temperature per hour.

If the air space were over 6 in. in thickness, the calculation would be exactly the same, except that the factor X_2/C_2, the resistance of the air space itself, would be omitted. The surface resistance of the concrete on the lower side and the wood on the upper side would, however, still be considered. These are the third and fourth factors in Formula 5: $1/K_1$ and $1/K_3$.

HEAT LOSS AND HEAT SAVINGS

Having calculated the overall resistance and coefficient of a roof, as explained previously, it is possible to obtain the total heat loss and to calculate the heat saving effected by the use of insulation on the roof.

EXAMPLE: Taking the case of a 4-in. concrete roof, with 5-ply tar and gravel roofing;

$$R=\frac{1}{1.3}+\frac{4}{8.3}+0.530+\frac{1}{3.75}=0.769+$$

$0.482+0.530+0.267=2.048.$

Coefficient = 1/2.048 = 0.488 B.T.U. per square foot per degree difference in temperature of the air in the building and the air outside per hour.

To find the overall resistance of the same roof with insulation applied, it is only necessary to add the resistance of the insulation to the overall resistance of the uninsulated roof. Therefore, after the overall resistance of the uninsulated roof has been calculated, the calculation of the overall resistance of the roof with any amount of insulation is a simple matter.

Assuming that the 4-in. concrete roof is to be insulated with a good type of insulation whose unit conductivity is, say, 0.329 B.T.U. per inch thickness, and whose resistance is 1/0.329, or 2.279.

Table 1—Coefficients and Overall Resistance of Uninsulated Roofs, Air to Air

(For 5-ply tar and gravel roofing, unless otherwise indicated by *.)

Thickness In.	Coefficient C	Overall Resistance R
BOARDS, SOFT PINE, FIR, SPRUCE, ETC.		
⅞	0.382	2.616
1	0.360	2.774
1 ¼	0.323	3.091
1 ½	0.292	3.416
1 ¾	0.268	3.726
2	0.247	4.038
2 ¼	0.229	4.356
2 ½	0.214	4.671
2 ¾	0.200	4.986
3	0.189	5.301
3 ½	0.169	5.931
4	0.152	6.566
5	0.127	7.856
6	0.109	9.096
BOARDS, HARD PINE		
⅞	0.412	2.425
1	0.392	2.553
1 ¼	0.355	2.816
1 ½	0.325	3.076
1 ¾	0.299	3.337
2	0.278	3.596
2 ¼	0.259	3.861
2 ½	0.243	4.121
2 ¾	0.228	4.381
3	0.216	4.641
3 ½	0.194	5.166
4	0.176	5.681
5	0.149	6.736
6	0.129	7.776
CONCRETE		
1	0.594	1.685
2	0.553	1.806
3	0.518	1.928
4	0.488	2.047
5	0.456	2.191
6	0.436	2.289
7	0.415	2.411
8	0.396	2.529
9	0.377	2.651
10	0.361	2.771
11	0.347	2.886
12	0.333	3.011
***CORRUGATED STEEL ON PURLINS**		
	1.870	0.535
***CORRUGATED STEEL ON SOFT PINE**		
⅞	0.512	1.953
1	0.473	2.111
1 ¾	0.327	3.059
2	0.296	3.375
*** CORRUGATED STEEL ON HARD PINE**		
⅞	0.568	1.760
1	0.529	1.890
1 ¾	0.373	2.673
2	0.341	2.933
*** WOOD SHINGLES ON HARD PINE BOARDS**		
⅞	0.400	2.499
*** SLATE ON HARD PINE BOARDS**		
⅞	0.418	2.339
1	0.405	2.469
1 ¾	0.308	3.252
2	0.285	3.513

Thickness In.	Coefficient C	Overall Resistance R
HARD PINE BOARDS, AIR SPACE, PLASTER (See Note A)		
⅞	0.200	5.000
2-IN. CONCRETE ON HOLLOW TILE		
6	0.395	2.529
8	0.336	2.977
HOLLOW TILE		
6	0.437	2.288
8	0.365	2.736
CHANNEL GYPSUM TILE		
1 ⅜	0.330	3.333
SOLID GYPSUM TILE (See Note B)		
3	0.250	4.000
HOLLOW GYPSUM TILE (See Note B)		
4	0.200	5.000
5	0.190	5.263
6	0.180	5.555
POURED GYPSUM SLAB (See Note B)		
3	0.170	5.882
4	0.140	7.143
FLAT CEMENT TILE		
1 ⅝	0.568	1.762
1 ⅞	0.558	1.792
HOLLOW FLAT CEMENT TILE		
3	0.309	3.234
"PORETE" SLAB		
1 ¼	0.345	2.894
CONCRETE WITH CINDER FILL (See Note C)		
4	0.382	2.620
5	0.362	2.764
6	0.350	2.862
7	0.336	2.984
8	0.323	3.102
FLOOR TILE, ON 5-PLY TAR AND FELT ROOFING, ON 4-IN. CONCRETE, PLASTERED BELOW		
1	0.313	3.196
*** CEMENT GROUT, ON 2 ½-IN. BOOK TILE ON 3-IN. CONCRETE, (NO ROOFING)**		
1	0.311	3.538

Note A—Resistance is the same regardless of thickness of air space, except that as the thickness increases, the resistance is decreased by convection currents. Figures given are for plaster on bottom of roof joists.

Note B—Figures for uninsulated gypsum roofs are the values published by the Gypsum Industries Association, Chicago, Ill.

Note C—The thickness of cinder fill is the average necessary to give drainage slope.

Note D—Surface effects have been considered in calculating all overall resistances.

Then 2.048 (overall resistance of uninsulated roof)
2.279 (overall resistance of insulating material)

4.327 (overall resistance of insulated roof).

Coefficient = 1/4.237 = 0.231 B.T.U. per square foot per degree difference in temperature of the air in the building and the air outside, per hour.

HEAT SAVING

The heat saving effected by the insulating material will be the difference between the coefficient of the uninsulated roof and that of the insulated roof, or

0.488 B.T.U. (Coefficient of uninsulated roof)
0.231 B.T.U. (coefficient of insulated roof)
0.257 B.T.U. per square foot per degree difference in temperature of the air in the building and that of the air outside, per hour, saving effected by the use of the insulating material.

FUEL SAVING EFFECTED BY INSULATION

Assuming that the 4-in. concrete roof has an area of 30,000 sq. ft. and that the inside temperature is to be 70° F., and the outside temperature is —10° F., or a total difference in temperature of 80°.

The heat saving effected by the insulating material is 0.257 B.T.U. per square foot per degree difference in temperature, per hour. Then 0.257 x 30,000 sq. ft. = 7710 B.T.U. per degree per hour, and 7710 x 80° = 616,800 B.T.U. saved per hour.

In calculating heating plants, 960 B.T.U. are considered to produce 1 lb. of steam. Then 616,800/960 = 642.5 lbs. of steam saved per hour.

It is generally considered that 1 lb. of coal will produce 8 lbs. of steam. Therefore, 642.5/8 = 80.3 lbs. of coal saved per hour.

(Continued on page 61)

Table 2—Thermal Internal (Not Air to Air) Conductivity and Resistance of Materials Used in Roof Construction

(Conductivity is in B.T.U. per square foot per degree difference in temperature, per hour and per inch thickness, unless otherwise specified and indicated by *)

Material	Conductivity	Resistance	Authority
Asbestos paper	0.500	2.00	Bur. Stds.
Asbestos mill board	0.830	1.204	Bur. Stds.
Air space under 6 in. thick.	1.570	0.637	Av. all authorities
*Cinder fill (usual thickness used to give drainage slope to roof)	1.750	0.573	Calculated
Cypress (across grain)	0.667	1.501	Bur. Stds.
Concrete (ordinary average)	8.300	0.120	Univ. Ill.
Fibrofelt	0.329	3.039	Bur. Stds.
*Gypsum roof tile for thickness given (air to air) (All figures for gypsum tile include 5-ply tar and felt roofing).			See text when hollow tile figures are to be used in problems to prevent condensation.
3-in. solid tile	0.250	4.000	Gypsum
4-in. hollow tile	0.200	5.000	Industries
5-in. hollow tile	0.190	5.263	Assn.
6-in. hollow tile	0.180	5.555	
Channel-shape tile, 1 ⅜-in. web	0.330	3.333	
3-in poured slab	0.170	5.882	
4-in. poured slab	0.140	7.143	
Linofelt	0.300	3.333	Bur. Stds.
Lith	0.379	2.639	Bur. Stds.
Maple, hard, across grain	1.125	0.889	Bur. Stds.
Mineral wool, medium packed	0.275	3.636	Bur. Stds.
Oak, across grain	1.000	1.000	Bur. Stds.
Pine, soft, across grain	0.791	1.264	Bur. Stds.
hard, across grain	0.958	1.043	Bur. Stds.
Plaster with lath, usual thickness	0.641	1.560	Bur. Stds.
Plaster on tile, etc., per inch.	5.500	0.182	Bur. Stds.
Plaster board	3.040	0.329	Bur. Stds.
Porete	0.941	1.062	Mass. Inst.
Roofing, tar, and felt, per inch	0.707	1.414	Bur. Stds.
*Same, 4 and 5-ply thickness	1.887	0.530	Calculated
Sawdust, ordinary and dry	1.040	0.961	Bur. Stds.
Shavings, ordinary and dry	0.707	1.414	Bur. Stds.
Tiling ⅞ to 1 in. thick (flooring tile)	9.000	0.111	
*Hollow fire-proof tile with ½ in. plaster both sides and surface effects included.			
2-in.	0.470	2.127	Univ. Pa.
3-in.	0.435	2.298x	
4-in.	0.400	2.500	
5-in.	0.380	2.631x	
6-in.	0.360	2.777	
7-in.	0.335	2.985x	
8-in.	0.310	3.225	
10-in.	0.285	3.508x	
12-in.	0.260	3.846	
14-in.	0.245	4.081x	
16-in.	0.230	4.347	
20-in.	0.200	5.000	

x—Interpolated from Univ. of Pa. data

*Hollow fire-proof tile (plaster and surface effects excluded, the latter being taken as surface coefficient 1.40. Plaster per inch, 5.50 conductivity.			
2-in.	7.874	0.127	Calculated
3-in.	3.355	0.298	from
4-in.	2.000	0.500	Univ. of
5-in.	1.584	0.631	Pa. data
6-in.	1.288	0.777	See text
7-in.	1.015	0.985	when these
8-in.	0.800	1.225	figures are
10-in.	0.663	1.508	used in
12-in.	0.541	1.846	problems to
14-in.	0.480	2.087	prevent con-
16-in.	0.426	2.347	densation.
20-in.	0.333	3.000	

This is the opening lesson of

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Lesson No. 1 Basic Heating and Ventilating Data

IN COMMENCING the study of Heating and Ventilating Engineering, it is absolutely necessary that we first become familiar with the media and terms with which we must deal. We have two natural substances, air and water, and one form of energy, heat.

SPECIFIC DENSITY—SPECIFIC VOLUME—SPECIFIC HEAT

These are terms which we will use frequently. We should understand clearly what they mean.

Specific density of a substance means the weight in pounds of a cubic foot of that substance.

Specific volume of a substance means the number of cubic feet in a pound of that substance.

Specific heat of a substance means the quantity of heat required to raise through 1° F. the temperature of 1 lb. of that substance under atmospheric pressure.

SPECIFIC DENSITY AND VOLUME OF AIR

Tables often designated as "Properties of Air" are to be found in various "hand-books" and in such tables, one column invariably contains values for the specific density or weight of a cubic foot of air at different temperatures under atmospheric pressure. A comparison of such a column

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(Do not fill in.) *Application for Enrollment for*

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(BY MAIL)
IN GRAVITY STEAM AND WATER HEATING

HEATING AND VENTILATING MAGAZINE CO.,
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GENTLEMEN:

I enclose $10.00 for which please enroll me as a student in the home-study course in steam and water heating which you have arranged for your subscribers to take from the A-Em-Dee Engineering Co., Heating and Ventilating Engineers, subject to the following conditions:

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(6) I agree on my part to prosecute the work energetically, to devote regular time to study (in so far as may be possible) and to complete it without delay unless interference is caused by sickness or other unavoidable causes.

Name.....

Address.....

Date..... Accepted.....

would show that the density changes as the temperature changes but not in the same manner. As a cubic foot of air becomes warmer, its weight becomes less.

Values for specific density and specific volume are not always given in the same table. It is frequently necessary to deduce the specific volume from the specific density. It is done by dividing (1) representing a cubic foot, by the specific density (number of pounds in 1 cu. ft.). So if the specific density of air at 30° F. is 0.08107 lbs., the specific volume will be $1 \div 0.08107 = 12.34$ cu. ft. per pound.

Work Problem No. 1

SPECIFIC DENSITY AND VOLUME OF WATER

Tables, similar to those for "Properties of Air" are also found in "hand-books" designated often as "Properties of Water." The weight of a cubic foot of water differs for different temperatures. This is due to the fact that as water is heated it becomes less dense and thus weighs less per cubic foot. Tables for "Properties of Water" contain a column showing the density or weight in pounds of a cubic foot of water for all temperatures between 32° and 212° F. The following are important temperature points:

Temperature Deg.	Condition	Weight pounds per cubic foot (Density)
32	Freezing Point	62.418
39.2	Maximum Density	62.427
62	Standard Weight	62.355
212	Boiling Point	59.760

It is advisable for the student to familiarize himself with such tables for air and water.

Work Problem No. 2

A U. S. gallon of water which is equivalent to 231 cu. in. weighs approximately 8 1/3 lbs. at a temperature of 62° F. A cubic foot at this temperature contains 7.48 gal.

Work Problem No. 3

PRESSURES MEASURED BY WATER COLUMN

Pressures are often stated in "feet head" or "inches of water column" and it may be advisable to express such in terms of pounds per square inch. At a temperature of 62° F., a column of water 1 ft. high that covers an area of 1 sq. ft. would exert a pressure of 62.355 lbs. per square foot or $62.355 \div 144 = 0.433$ lbs. per square inch. So for a column 15 ft. high, the pressure at the base would be $15 \times 62.355 = 935$ lbs. per foot or $15 \times 0.433 = 6.52$ lbs. per square inch.

Work Problem No. 4

Pressures are also frequently given and recorded in ounces per square inch of water pressure. If the head or pressure in inches of water at a temperature of 62° F. be divided by 12 (inches per foot), this quotient multiplied by 62.355 (weight of 1 cu. ft. at 62° F.), this quotient divided by 144 (square inches per square foot) and the resulting product multiplied by 16 (ounces per pound), the result will be the pressure in ounces per square inch. Or, expressed so as to convert recorded pressure in ounces per square inch to equivalent head in inches of water: multiply the recorded pressure by 1.73 to obtain head in inches of water.

Work Problem No. 5

Specific volume of water as for air is obtained by dividing one (1) by its specific density at a given temperature.

Work Problem No. 6

It is often necessary to express a given volume of water at a known temperature as equivalent pounds. To do this a "Properties of Water" table is used. Selected values from such a table are given directly below.

Temperature Deg.	Weight per cubic foot, pounds
60	62.37
80	62.23
100	62.02
120	61.74
140	61.37
160	60.98

Suppose it is desired to know the weight in pounds of 5.47 cu. ft. of water at 80° F.

5.47 (cu. ft.) $\times$ 62.23 (lbs.) = 340.4 (appx.), total pounds.

Work Problem No. 7

TEMPERATURE AT WHICH WATER BOILS

Water boils at different temperatures. The boiling temperature depends upon the pressure. At sea level, atmospheric pressure is equal to 14.7 lbs. (appx.) per square inch. The boiling temperature at this pressure it 212° F. On the top of a mountain 10,685 ft. above sea level, atmospheric pressure is equal to 9.74 lbs. per square inch, due to the decreased density of the air. Under this pressure pure water would boil at 192° F. So by reducing the pressure, the boiling point of water may be lowered. This is an important fact and should be remembered as we will have frequent occasion to apply the principle as we progress in our study of the application of fundamental principles.

WHAT IS A HEAT UNIT?

No part of our preliminary preparations is near so important as that we should understand perfectly the term, B.T.U. It stands for a unit of heat.

If the bulb of a thermometer is immersed in a

pail of water, the height of the mercury column will indicate the temperature of the water. But the quantity of heat in the water will not be known. The temperature, however, may be a means by which the quantity of heat may be determined.

If 1 lb. of water at 62° F. be raised to 63° F. at atmospheric pressure, a definite quantity of heat will have been imparted to the water. Careful experiments have shown that for a degree rise at any point between 32° and 212° F. the quantity of heat imparted differs. In other words, the quantity of heat required to raise a mass of water 1° F. is not a constant quantity throughout the thermometric scale. It is so nearly constant though, that it is common practice to define a B.T.U. as the 1/180 part of the heat required to raise 1 lb. of water from 32° to 212° F., or through 180° F.; or as the heat required to raise the temperature of 1 lb. of water 1 degree. So the quantity of heat required to raise a given quantity of water at a definite temperature to a desired temperature may be found by multiplying the weight of water in pounds by the temperature difference in degrees. Thus, 125 lbs. of water at 40° F., if raised to 190° F., will require 125 (lbs.) × (190-40) = 18,750 B.T.U.

Work Problem No. 8

SPECIFIC HEAT

Specific heat is a term used frequently in heating calculations. It has been defined (for a given substance) as the ratio of the heat required to raise the temperature of the unit weight of that substance 1° F. and the quantity of heat required to raise the temperature of the same weight of water 1° F., usually from 62° to 63°. Some engineers contend that a more correct name for the quantity is "coefficient of thermal capacity."

Applied to water, specific heat means the number of units of heat required to raise 1 lb. (the unit weight of water) through one unit of temperature. As explained above, the quantity varies slightly with the temperature but the difference is so little that the specific heat or "coefficient of thermal capacity" of water is quite commonly taken as unity and so used in most heating calculations. Values at each of five different temperatures are given below as evidence of the very slight difference.

Temperature, Deg. F.	Specific Heat
30	1.0098
55	1.0000
100	0.9967
160	1.0002
210	1.0050

Applied to air, specific heat has quite a different value than for water. Suppose the B.T.U. required to raise the temperature of 1 lb. of water from 62° to 63° F. is called A, B.T.U. and that the quantity of heat required to raise the temperature of 1 lb. of air 1° from any temperature between, say, 22° F. below zero to 200° F. above zero and under the same conditions of pressure as for the water, is measured and called B, B.T.U. If the B quantity be divided by the A quantity, a value that represents the relation that exists between these two heat quantities will be obtained.

Suppose the value of the A quantity were twice as large as the B quantity. The relation number would then be 0.50, which would indicate that for a given quantity of air just one-half as much heat would be required to raise its temperature a definite number of degrees as would be required to raise the temperature of an equal amount of water through the same number of degrees. This relation, expressed as a decimal, is what is known as the specific heat or coefficient of thermal capacity of the substance.

For air, under conditions of constant pressure and within practical working temperatures, it is taken as 0.24 B.T.U. per pound. In other words, practically, it requires but 24/100 as much heat to raise the temperature of 1 lb. of air 1° F. as it does to raise 1 lb. of water 1° F.

So the quantity of heat required to raise the temperature of a given quantity of air at a definite temperature to some desired temperature may be found by multiplying the weight of air in pounds by the temperature difference in degrees and this product by the coefficient of thermal capacity. Thus 125 lbs. of air at a temperature of 40° F., if raised to a temperature of 190° F. will require 125 (lbs.) × (190-40) × 0.24 (coef.) = 4,500 B.T.U.

The value for the specific heat of air, as determined by various investigations varies from 0.2375 to 0.2430. The value commonly used is 0.24.

Work Problem No. 9

LATENT HEAT OF EVAPORATION

This is a term commonly heard and frequently used in connection with heating calculations, especially in steam work, when heat in sufficient quantity is added to water, the water is changed from the liquid to the gaseous state which is steam. It will remain steam just so long as the quantity of heat which was required to change it from a liquid into a gas remains in it. This quantity of heat is known as the Latent Heat of Evaporation.

When the application of heat results in a change of state of a substance, either from solid to liquid or from liquid to gaseous, there occurs an absorption of heat without rise in temperature and the heat thus absorbed is termed LATENT (or hidden), because it apparently disappears, and may not be measured with a thermometer. It is not lost, however, but re-appears whenever the substance passes through the reverse cycle, that is, from a gaseous to a liquid or from a liquid to a solid state. LATENT HEAT is, therefore, the quantity of heat which apparently disappears, or is lost to thermometric measurement, when the molecular constitution of a body is being changed. It is expended in performing the work of overcoming the molecular cohesion of the particles of the substance, and in overcoming the resistance of external pressure to change of volume of the heated body.

LATENT HEAT AS APPLIED TO WATER

To understand this perhaps better, consider a pound of water in the three states, solid (as ice) liquid (as water) and gaseous (as steam). If heat be applied to a pound of ice at some temperature below 32° F., there will be a rise in temperature until 32° F., the freezing point, is reached. The ice will then begin to melt, but the temperature of the mixture of ice and water will remain 32° F. as long as any particle of ice remains in it.

Yet the melting process will absorb heat, NOTE THAT. This amount of heat thus absorbed in changing the state of a pound of ice from ice at 32° F. to water at 32° F. is 144 B.T.U. It is called the LATENT HEAT OF FUSION of ice.

Now if the application of heat be continued, the temperature of the water (after all the ice is melted) will rise, but about twice as many units (the ratio of 0.463 specific heat of ice to 1, the specific heat of water) as before, will be required to raise it 1° F. When the temperature of the water has reached 212° F., there begins a further absorption of heat but no increase in temperature. Boiling occurs, and the absorbed heat is expended in transforming the water into steam. Water at atmospheric pressure cannot be heated above 212° F. When the entire pound of water has been changed or evaporated into steam, 971.7 B.T.U. will have been added. This is the LATENT HEAT OF EVAPORATION of water.

Work Problem No. 10

(*For students who have had no previous instruction in heating and ventilation, additional text on the principles involved will be mailed upon request. This additional matter is devoted to the topics of air, water and heat, the different systems of heating in common use, the principles of ventilation, composition of oxygen, action of oxygen with carbon, the use of carbonic acid as an index of the quality of the air, carbon monoxide, humidity and the influence of water vapor upon ventilation*).

HEATING REQUIREMENTS

The quantity of heat required to maintain a desired temperature within a building or part thereof depends primarily upon two conditions:

(a) the purpose for which the building or part thereof is to be used,

(b) the outside temperature conditions which are likely to prevail in the locality.

The amount of heat which must be supplied hourly is governed by,

(1) the quantity that passes to the outside through walls, windows, doors, ceilings, roof and floors,

(2) the quantity required to raise the temperature of the outside air which enters either by leakage or is introduced for ventilating purposes, to the temperature to be maintained within,

(3) the quantity supplied by persons, lights, machinery, or other sources of heat generation within the building or part thereof.

Heat may be transmitted from a body (such as a water and steam radiator) or "lost" from a building or part thereof by Radiation, Conduction and Convection.

Radiant heat is transmitted from all bodies, the net amount of heat radiated from a body being the difference between the total amount radiated from it and the quantity radiated from other bodies that is absorbed by the body itself. Radiant heat fol-

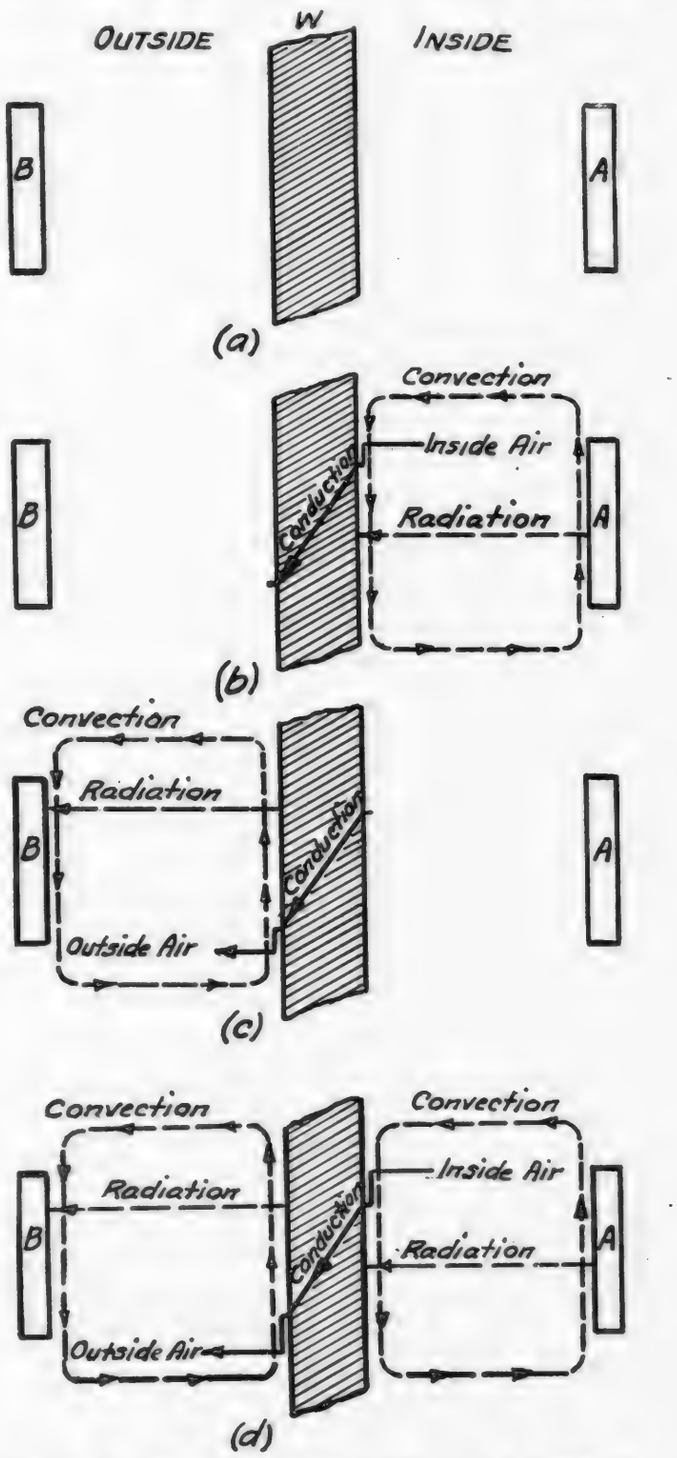

Fig. 1—How Heat is Transmitted from and to Objects on Two Sides of a Homogeneous Wall

SURFACE COEFFICIENTS FOR INSIDE WALLS
(Combined Radiation and Convection for Still Air)

TABLE 1 (HARDING & WILLARD)

Building Material	Coefficient, K_1
Brickwork	1.35 to 1.40
Concrete	1.30
Corkboard	1.25
Cement, Plaster Finish	0.93
Glass Window	1.50
Sheet Asbestos	1.40
Magnesia Board	1.45
Wood (finished surface)	1.40

MULTIPLIERS FOR OBTAINING SURFACE COEFFICIENTS, K_2 FOR OUTSIDE WALLS UNDER MOVING AIR CONDITIONS

TABLE 2 (HARDING & Willard)

Wind Velocity, Miles per Hour	Multipliers for K_1	
	Brickwork	Wood
5	2.38	2.19
10	3.20	2.71
15	3.76	2.95
20	4.22	3.02

TABLE 3 CONDUCTIVITY COEFFICIENTS, C. (HARDING & WILLARD)

B.T.U. transmitted per sq. ft. per hr. per inch thickness per degree F difference in temperature of the two surfaces. Materials thoroughly dry.	
	C
* Brickwork	4.00 - (5.00)
Cement (Stone 1·2·4 mix)	8.30
Wood (Fir) 7/8" Thick	1.00
Corkboard Insulation	0.32
Corrugated Asbestos	0.48
Sheet Asbestos	0.29
Magnesia Board	0.51
* Recommended that Value of C = 5 be used.	
The following figures are the conductiveness for the thickness stated. (B.t.u. per sq. ft. per hr. per degree difference in temperature of the two surfaces)	
Glass (0.085")	24.3
Window (76.3% glass)	8.64
Double window with 1/2" air space	1.04
2" Hollow Tile plastered both sides	0.99
4" " " " " "	0.61
6" " " " " "	0.46
2" " " " " " with ready prepared gravel roofing applied to one side only	0.47
Concrete (Stone 1·2·4 mix) (Norton)	6.25
Concrete (Cinder ") (")	2.35
Brickwork (Poensgen)	3.42
Sandstone (")	9.00
Packed Granulated Cork (6.25# per cu. ft)	0.35
Packed Mineral Wool (16.3# per cu. ft.)	0.35
Mortar	8.00
Slag Roofing (5 Ply) 1/8" thick	0.40

lows certain definite physical laws, the principal one being stated as *The Intensity of Radiant Heat is Inversely Proportional to the Square of the Distance from the Source.* So, if a body is radiating 1,600,000 B.T.U. at a distance of 4 ft., the intensity of heat radiated will be equal to the quotient of 1,600,000 divided by 4^2, or 100,000 B.T.U.

Work Problem No. 11

Conducted heat is heat that passes from one part of a body or substance (or from one substance to another when the two are in direct contact) at one temperature to another part of the body at a lower temperature. Thus a flow of heat occurs through a body such as a brick wall when one side is warm and the other side comparatively cool. Different materials of which walls, floors, ceilings, roofs of structures are constructed conduct heat to a less or greater extent. Metals are better conductors than other materials so there will be a greater quantity of heat conducted through a metal roof in a given time than if the roof were built of some other material unless means for insulating it exist. Wood, felt, asbestos, etc. are examples of poor conductors.

The transmission of heat from a body by convection results when the warm or hot body is in contact with a fluid at a lower temperature, as with air in contact with a water or steam radiator or water surrounding a steam-filled pipe. The envelope of fluid surrounding the body becomes heated by conduction of heat from the body. As this part of the fluid is heated, it rises (due to the decrease in density) and is replaced by another layer of the fluid from below which in turn rises and thus a continuous current is created and maintained over the surface of the hot body. The heat thus carried away or conveyed is in turn given off to some colder body with which the fluid comes in contact, its density again increased, and it returns to the hot body to complete the cycle of operation. The essential characteristic of the process of convection is a continuous renewal of the fluid layer at the surface of contact.

TRANSFER OF HEAT

The manner in which heat is transmitted from and to objects on two sides of a homogeneous wall is shown graphically in Fig. 1. At (a), two objects, A and B are shown on opposite sides of the wall. If A has a higher temperature than B, heat will be transmitted from A to the wall by radiation, conduction and convection, as indicated at (b).

An infinite number of heat rays will radiate from A through the air without appreciably heating it, to the colder receiving surface or inside of the wall. The air in contact with A will become heated and rise, thus setting up a convection current as indicated and carry heat to the inner surface of the wall. Heat brought to the inside wall surface will be conducted through it as indicated by the heavy solid line drawn at an angle. The magnitude of the angle will depend upon the rate at which heat is conducted, the more nearly horizontal, the greater the conduction. Heat thus reaching the outer surface of the wall will be emitted in a reverse order to that received by the inner surface.

At (c) heat is shown radiating from the outside surface to B in straight lines, and carried by the convection current as indicated. Thus, as shown at (d), the transfer of heat will continue until the temperatures of A and B are equal.

In like manner heat is transmitted from a room to the outside but to a greater or less extent depending upon the type of construction. Factors, known as coefficients or multipliers and determined by experiments are applied when calculating the "heat loss" for a particular problem. These are known as coefficients, (1) of radiation, (2) of convection, and (3) of conduction.

COMBINED COEFFICIENTS OF RADIATION AND CONVECTION

Since, in experimental work it is difficult to separate the heat that is given off by a body by radiation from that removed by convection, whereas the combined heat loss due to both radiation and convection in practically still-air tests may be obtained quite accurately, these two coefficients are usually applied as the combined effect and as such are frequently referred to as the surface coefficient.

The surface coefficient, therefore, means the B. T.U. absorbed or given off per square foot of surface per hour by radiation and convection (under definite conditions of air movements), per degree difference in temperature between the surface and the average temperature of the air. With different air movements on the two sides of a wall, the values of the surface coefficients will differ since the "heat loss" by convection will differ.

Coefficients derived from tests conducted under practically still-air conditions (the only movement being that caused by natural currents existing in the test room) are given in Table 1.

Surface coefficients for outside walls for moving-air conditions will be governed by the nature of the outside surface and the velocity of air movement over it. A general rule adopted by some engineers is to consider the outside surface coefficient as equal to three times that for a corresponding inside surface. This figure is based on the assumption that exposed walls of a building are seldom subjected to an average wind movement of more than 15 miles per hour in extremely cold weather.

More specific values for outside wall coefficients for brickwork and wood for known wind velocities may be obtained by applying the multipliers given in Table 2.

Work Problem No. 12

CONDUCTIVITY OF MATERIALS

The property of conducting heat is possessed by all materials. The factor which indicates the quantity of heat that a material having parallel surfaces will transmit through it when the surfaces are at different temperatures is called its conductivity. The amount of heat conducted varies directly as the difference in the temperatures of the surfaces

and inversely as the thickness. Thus great temperature differences mean rapid conduction while the thicker the material the less heat conducted.

COEFFICIENT OF CONDUCTIVITY, C

Coefficients of conductivity are determined through experiments. Those obtained by different investigators will likely differ slightly since different samples of the same kind of material may vary considerable in density and conductivity.

Table 3 contains conductivity coefficients for various building materials. The values in this table are given as B.T.U. per square foot of wall surface per hour per inch thickness per degree F. difference between the two surfaces, for thoroughly dry materials.

With these data, the heat transmitted by conduction per square foot per hour may be obtained by subtracting the outside wall temperature from the inside wall temperature and multiplying the difference by the coefficient of conductivity as taken from Table 3 and then dividing by the thickness of the material in inches.

Work Problem No. 13

The values given in Table 3 should not be confused with those used later, (called "heat loss" coefficients) for walls composed of several layers of different materials. These values together with the surface coefficients, Tables 1 and 2, are used to derive values for "heat loss" coefficients for composite wall construction.

CALCULATING HEAT TRANSMISSION COEFFICIENTS

Various tables containing values for different types of wall construction are available in handbooks but in order to assure uniformity in this course, such tables will be presented from time to time and the student will be expected to use the values contained therein.

In all engineering work, tables are to be found that shorten the processes involved but to use a table without having some idea of how the matter contained therein was developed is liable to lead to undesirable results. Consequently, we will consider the development of values for "heat loss" coefficients (which we will designate as f) and calculate values for several typical walls before presenting tables containing such values.

The fundamental of heat transfer is stated as follows: the quantity of heat received by the inside surface of a wall, the quantity conducted through the wall and the quantity given off by the outside wall surface are equal to one another.

Thus we have three equal quantities, the values for which may be obtained as follows:

(1) The quantity of heat transmitted per square foot per hour for a given difference in temperature will be equal to the total temperature difference in degrees between the inside air and outside air multiplied by a factor (which we will designate as f) which is equal to the heat transmitted through an actual wall per square foot per hour per degree difference in temperature of the air on the two sides.

(2) The quantity of heat received by the inside surface of the wall will be equal to the product of the inside surface coefficient K_1 (explained above) by the difference in temperature between the temperature of the inside air and inside wall.

(3) The quantity of heat given off by the outside wall surface will be equal to the product of coefficient K_2 (explained above) by the difference in temperature between the temperature of the outside wall and outside air.

(4) The quantity of heat conducted through the material will be the difference between the temperature of the inside wall surface and outside wall surface multiplied by coefficient C (explained above) and this product divided by the thickness of the material in inches.

From the equality relation between these quantities a value for factor f may be deducted for any wall if values of the coefficients K_1, K_2, and C and the thickness are known or assumed. The following form may be used.

First:—Divide the numeral 1 (one) by the value of K_1 (from Table 1) corresponding to the wall in question.

Second:—Divide the numeral 1 (one) by the value of K_2 (as determined from Tables 1 and 2) corresponding to the proper wall.

Third:—Divide the thickness in inches by the value of C (from Table 3) for correct conditions.

Fourth:—Add results First, Second, Third.

Fifth—Divide numeral 1 (one) by result Fourth and obtain a value for factor f for the particular wall.

The value of f thus obtained may be used in making "heat loss" calculations for such a wall.

In Fig. 2 there are illustrated a 13-in. brick wall, four types of composite walls and one roof composed of the materials noted opposite each wall section.

It is desired to derive a value for f for the 13-in. brick wall shown at Fig. 2-(a). The values for the known factors are as follows:

$K_1 = 1.4$ (from Table 1).
$K_2 = 4.2$ (taken as $3 \times K_1$).
$C = 5$ (from table 3).
$T = 13$ in.

Applying the five-step form given directly above, a value of $f = 0.281$ is obtained.

Work Problem No. 14

CALCULATING COEFFICIENTS FOR COMPOSITE WALLS

Thus far we have considered only a wall composed of the same material throughout. If the wall consists of several different materials in direct contact with one another (no air spaces between), then to find a value for factor f we must proceed as follows:

First:—Divide the thickness of each different material in inches by the proper coefficient of conductivity and add the results obtained.

Second:—Divide numeral one (1) by the surface coefficient K_1 for the inside wall surface (from Table 1).

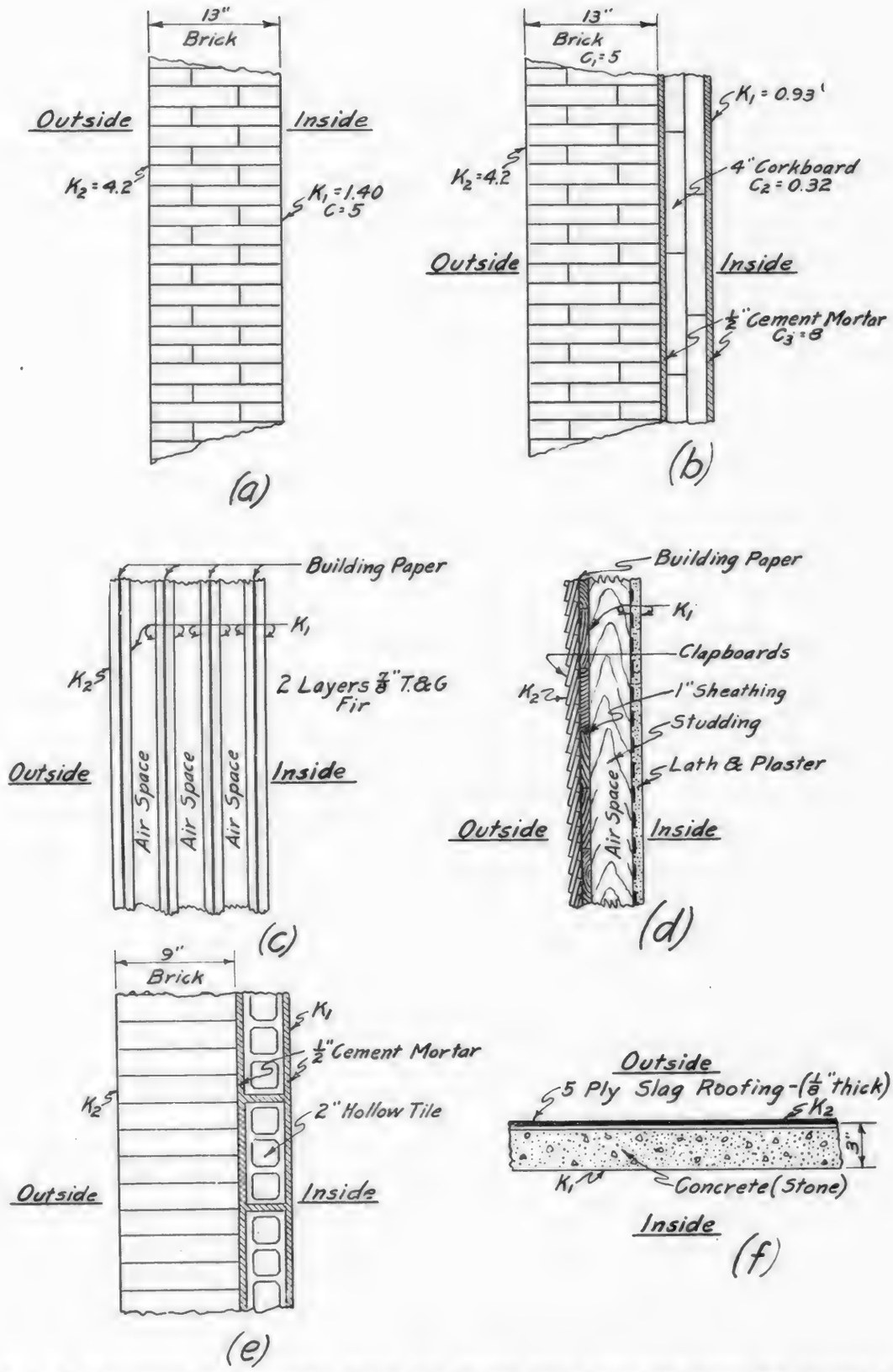

Fig. 2—Examples of Composite Walls for Which Heat Loss Coefficients are Derived in Application Problems

Third:—Divide numeral one (1) by the surface coefficient K_2 for the outside wall surface (as derived).

Fourth:—Add results First, Second and Third.

Fifth:—Divide numeral one (1) by results Fourth, and get a value for factor f.

The value for the thickness divided by coefficient of conductivity for thin metal plates, building paper or glass is so small that it may be safely neglected in calculations.

In Fig. 2-(b) there is illustrated a composite wall consisting of two thicknesses of cement mortar, 4 in. of corkboard and 13 in. of brick. It is desired to derive a value for f for this wall. The values for the known factors are as follows:

$K_1 = 0.93$ (from Table 1).
$K_2 =$ for brick wall $= 4.2$ (taken as $3 \times K_1$).
T for brick wall = 13 in.
T for corkboard = 4 in.
T for cement mortar $= 2 \times \frac{1}{2}$ in. $= 1$ in.
C for brick wall = 5 (from Table 3).
C for corkboard = 0.32 (from Table 3).
C for cement mortar = 8 (from Table 3).

Applying the five-step for given directly above, a value of f = 0.053 is obtained as follows:

First: $(13 \div 5) + (4 \div 0.32) + (1 \div 8) = 15.225$
Second: $(1 + 0.93) = 1.07$.
Third: $(1 + 4.2) = 2.383$.
Fourth: $15.225 + 1.07 + 2.383 = 18.678$.
Fifth: $1 \div 18.678 = 0.053$.

Work Problems Nos. 15, 16, 17 and 18

APPLYING HEAT LOSS COEFFICIENTS, f

Knowing the heat loss coefficient, f, for a given wall construction, the transmission in B.T.U. per square foot, of surface per hour can easily be obtained for any values for inside and outside temperatures by multiplying the temperature difference by the value f. In a foregoing paragraph for a 13-in. brick wall we determined a value f = 0.281.

Applying this for inside temperature of 70° F. and outside temperature of 0° F, the heat loss under these conditions will be $0.281 \times (70 - 0) = 19.7$ B.T.U. per square foot of surface per hour.

Work Problems Nos. 19, 20 and 21

Lesson No. 2, to appear next month will cover the application of heat-loss coefficients to walls containing windows and doors, present tables for different types of building construction, discuss the effect of types of construction on heat loss, how exposure affects heat-loss calculations and how heat required to care for infiltration requirements may be computed.

Further Data on Quartz Windows

An item in THE HEATING AND VENTILATING MAGAZINE for July, 1924, told of the experiments made by Dr. Edward R. Berry, assistant director of the Thomson Research Laboratory of the General Electric Company, in the manufacture of fused quartz, which could be used in place of glass for windows. As was emphasized by Dr. Berry, it is believed that quartz, or rock crystal, will transmit the ultra-violet rays of sunshine, which are considered by many to be the secret of "fresh" air while the ordinary glass windows, it is stated, do not let them through.

The process used by Dr. Berry involved the use of a special type of electric furnace for the melting of the quartz, in which the heat is furnished by the electrical resistance of a carbon cylinder, within which the graphite crucible is contained.

The raw material is rock crystal of high purity, and this is melted in the furnace under much reduced atmospheric pressure so as to remove the maximum amount of air and other impurities. The fused quartz, at a temperature of close to 2,000° C. or about 3,600° F., is then squeezed out through holes, either by pressure or its own weight, and formed into rods or tubes, or it is cast into blocks or other shapes desired.

Possible applications of this new product may be seen from a recital of some of its more important characteristics. First, it transmits light almost completely without shutting off either the life-giving ultra-violet or the heat-giving infra-red rays. It makes easily possible the medical use of ultra-violet light either by indoor exposure to sunshine, or by the use of mercury vapor lights in quartz bulbs. Light travels down a rod of quartz much as water down a tube. Little is reflected out of the sides. So it is possible to put a source of ultra-violet light at one end of a small glass tube or rod, and transmit it almost unimpaired to the interior of the body. Ultra-violet light has been known to be fatal to the germs which cause such diseases as pyorrhea, nasal infections, and similar morbid conditions, and the light can be turned on just where it is needed.

Quartz is silicon dioxide of which a large part of the crust of the earth is composed, but so far it has not been found practicable to make the fused quartz from anything but rock crystal, which, however, is fairly abundant and cheap. To make the highest quality of optical quartz it is necessary to remelt the quartz under a pressure of about 600 lbs. This compresses any bubbles remaining in it so as to make them of insignificant size. This quality has not as yet been placed on a commercial basis, Dr. Berry said.

As for the immediate future, Dr. Berry exhibited a block of fused quartz a foot long, which will be sawed by diamond saws into window panes for use in a children's clinic in a large hospital. The ultra-violet rays of sunshine cure rickets and tuberculosis. and the quartz panes will let all the sunshine in to the bodies of the children without exposing them to the chill of outdoors.

Back To First Principles

Plain Answers to Direct Questions on Present-Day Heating and Ventilating Practice

By T. W. Reynolds

(*Continued from the October issue*)

43. Q. *What is the principle involved in circulating water below its heating source without mechanical appliances?*

A. It is generally understood that the principle involved in gravity water heating is a simple one of water circulation by gravity, that is, the difference in specific gravity or weight between the heated water and the cooler water establishes circulation, and accordingly considerable attention must be given to the design of a system so that it will be balanced to insure uniform circulation throughout.

It may under certain conditions become quite difficult to obtain the proper flow, for even with the most favorable design, the motive power causing circulation is very slight, and, as a consequence, one of the most interesting of heating problems is that of circulating water below its heating source without mechanical appliances. This is one of the most adverse conditions in water heating work, requiring the proper proportion of elevation to depression and the elimination of all air, as the great est hindrance to the circulation of water is air.

CIRCULATING WATER TO BASEMENT RADIATORS AT HEATER LEVEL

Interesting in connection with such problems in water circulation is the following sketch of an installation at the Irvington Pastime Club as designed by the Burnham Boiler Corporation and installed by Mr. Murphy of Irvington-On-The-Hudson, N. Y.

As shown in Fig. 30 the piping is arranged so that the increased flow of water which always takes place through higher radiators will assist the circulation in the lower or basement radiators (See basement radiators shown filled in solid with black). The

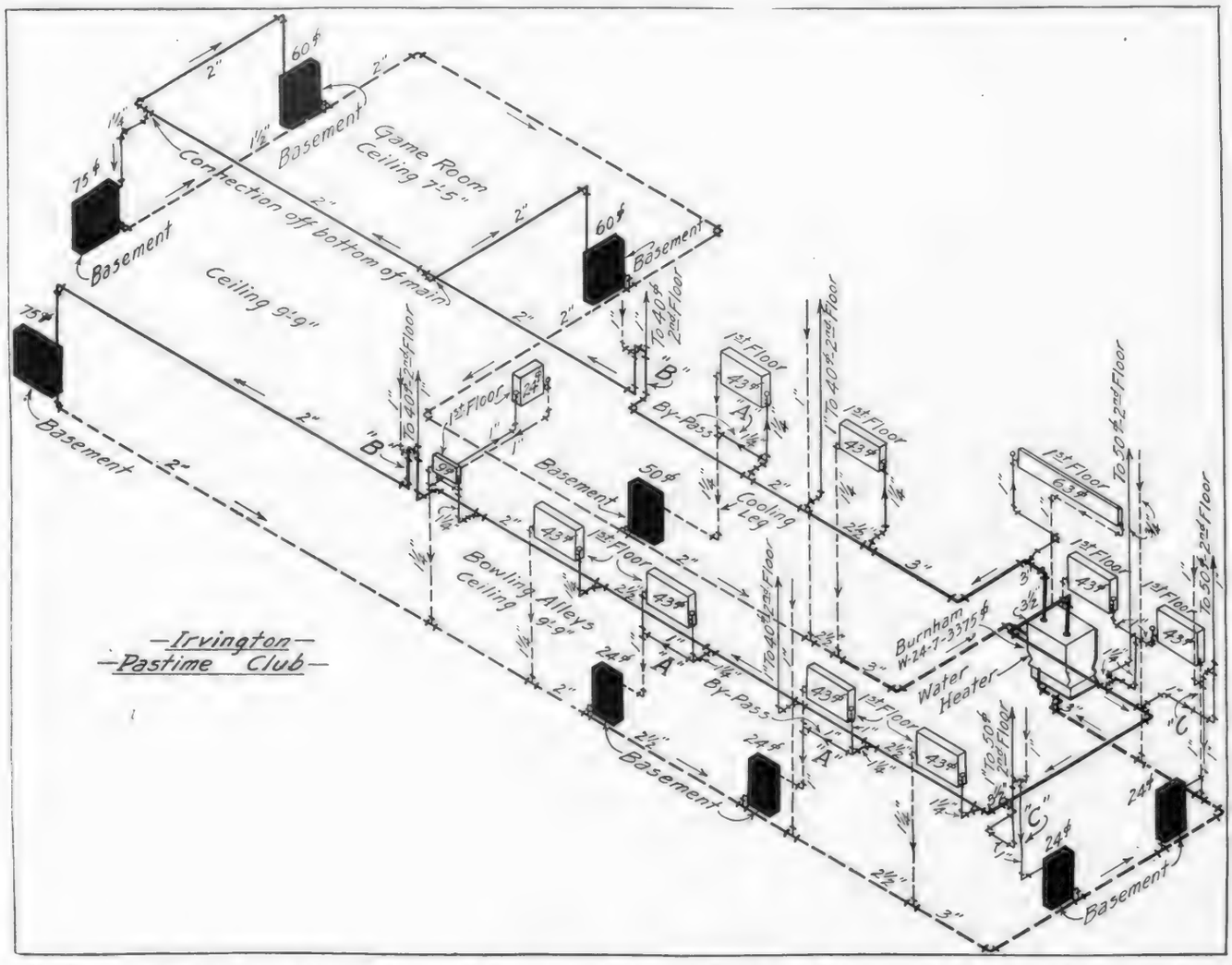

Fig. 30—Gravity Water Heating System in Irvington Pastime Club, with Basement Radiators at Heater Level.

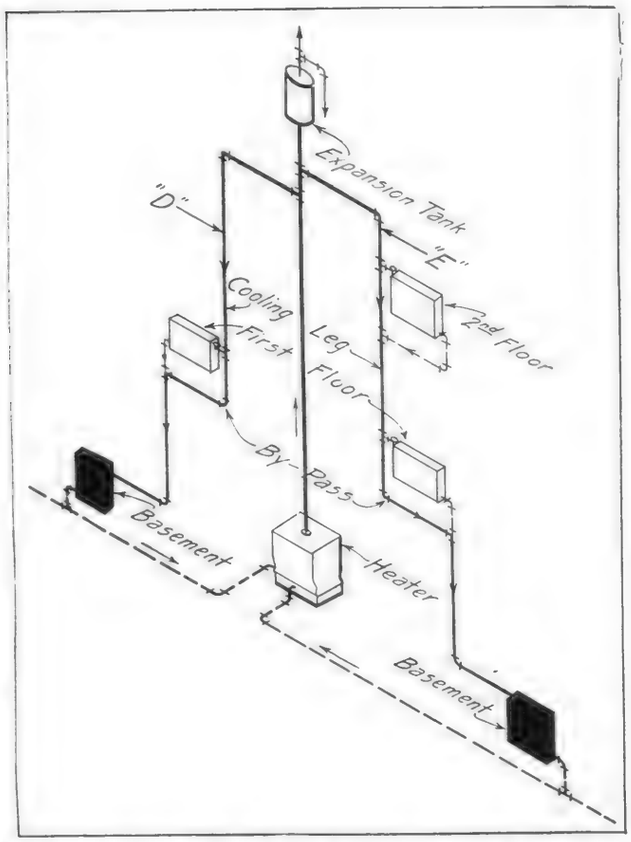

Fig. 31—How a Down-Feed System Could Have Been Arranged to Obtain Better Circulation

returns from the higher radiators are passed through these lower radiators, otherwise there would be but little motive head for circulation through the latter due to their position on the same level as the heater.

Obviously, no valves can be used on the basement radiators without stopping the flow through the upper radiators, but if this condition should ever become undesirable it can easily be remedied by means of additional piping and valves properly arranged. However, in the present case, the basement contains the bowling alleys and game rooms which must be heated when the building is open. Furthermore, the system as now arranged has the advantage of being automatic, no manual labor or manipulation of valves at the by-passes being required whenever upper radiators are cut out or in.

If an upper radiator is valved off the water is automatically by-passed, as shown at "A," "B," and "C." Whenever this occurs the circulation to the lower radiators will not be as great as before, yet circulation will still take place due to the difference in weight of water in the two vertical pipes as at "B," the water cooling, therefore lowering in the pipe shown at the left hand side. Further assistance will also be obtained due to the cooling effect of basement radiators and connecting piping, the latter being left without covering for this reason.

Even greater circulation could have been obtained if the main flow riser from the heater had been carried up first to the attic and the drops then taken from this so as to supply all radiators on floors below, as typical of any downfeed system. The method which would be used in such a case, though on a more extensive scale than shown, is illustrated in Fig. 31. All of the drop lines would then be adding their cooling effect, and, should the valve on an upper radiator be closed at any time there would still be much more active circulation to the basement radiators than is possible under the present arrangement.

As an illustration of the point, note the conditions in Figs. 30-31 and compare the height of the cooling leg at "A" with that at "D." In the latter case the basement radiator would have a much greater circulation due to the greater height of its supply riser or cooling leg. Again, had the piping been arranged, as at "E," the circulation to basement radiators when upper radiators were valved off, though not improved over the more favorable method ("D") suggested, would, however, be very much greater at other times than either method "A" or "D." This would be because of the colder or heavier water being discharged from the uppermost radiator at the higher point.

TROUBLES WITH BULL-HEAD TEES AND CONNECTIONS

44. *What troubles may be expected with bull-head tees and connections?*

Trouble in a heating system which was traced to the improper use of bull-head tees and connections (See Fig. 32) was experienced recently in a Washington Hotel. A number of the air valves on radiators spouted water, in particular one on a radiator whose shut-off valve had been closed the night before because of this same trouble, yet here it was spurting water again quite liberally.

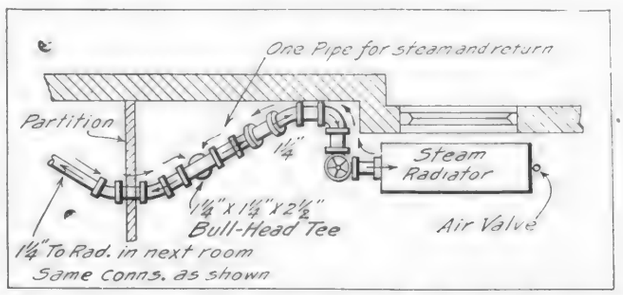

Fig. 32—Bull-head Connections at Radiators Causing Air Valves to Spout Water

Apparently the valve disc did not close tightly. Furthermore, the valve spindle must have contracted during the night when the system cooled under lowered pressure. Assuming this to be the cause, with steam turned on in the morning, it would for a time find its way into the radiator below the partially-opened disc, and, as such opening would be very small, the water in the radiator could not flow out against the incoming steam, as required in a one-pipe steam system. Because of this, it would accumulate at the opposite end of the radiator causing the float of the air valve to jam in the open position, especially if proper care of the valve had been neglected and the pressure was rather high in

starting. Meanwhile the troubles would be intensified, because the rapid condensation of steam when first heating the cold metal of the radiator would leave a space or vacuum tending to hold back the water against the pressure of the entering steam. The trouble of the night before was no doubt due to a somewhat similar cause, the valve had been opened but part of the way—not a good practice in a one-pipe system where condensate must flow counter to the steam.

As will be noted the bull-head tee shown in the sketch (Fig. 32) does not conform to the usual specification that "No cross fittings or bull-head tees shall be used, except for cleaning provisions." Bull-head tees should never be used as they cause considerable friction and uneven division of the flow, particularly in one-pipe steam heating systems. In such cases there are two dividing streams of steam flow, as well as two other streams of condensation flowing counter to the steam, yet coming together at the above division point, so that the conditions are especially bad. Such a practice increased the troubles outlined at the start (See Fig. 32).

(*To be continued*)

The Insulation of Roofs to Prevent Heat Loss and Condensation

(*Continued from page 49*)

The saving, as figured above, is always calculated first for the minimum outside temperature, in this case —10° F. This gives the saving based on maximum fuel demand. The heat saving for the year, however, must be calculated on the basis of the mean outside temperature throughout the entire heating season and for the length of heating season for the particular locality in question.

We will assume that the mean outside temperature throughout the heating season is 42° F., and that the building is to be heated to 70° during 12 hours of the day, and to 55° during 12 hours of the night.

SURFACES COEFFICIENTS (STILL AIR)

Brick wall	1.40	0.714	Univ. Ill.
Cement (plaster finished)	0.93	1.075	Univ. Ill.
Concrete	1.30	0.769	Univ. Ill.
Wood, fir (one surface finished)	1.40	0.714	Univ. Ill.
Corkboard	1.25	0.800	Univ. Ill.
Magnesia board	1.45	0.789	Univ. Ill.
Glass window	1.50	0.666	Univ. Ill.
Glass (window)*	1.90	0.526	Univ. Pa.
Glass (actual glass 91.4% of total area)	2.00	0.500	Univ. Ill.
Glass (double ½ in. air space. Glass 69.3% of total area)	2.00	0.500	Univ. Ill.
Tile, plastered on both sides	1.10	0.909	Univ. Ill.
Asbestos board	1.60	0.625	Univ. Ill.
Sheet asbestos	1.40	0.714	Univ. Ill.
Roofing	1.25	0.800	Univ. Ill.
Iron	1.20	0.833	Univ. Ill.
Building Paper	1.40	0.714	Univ. Pa.

* Average of both sides of glass 0.12 in. thick and for 70° F., total temperature difference from air to air with moving air on one side. Probable values for still air on both sides, 1.60.

With 70° inside and — 10° outside, the difference in temperature is 80°. With 70° inside and 42° outside, the difference in temperature is only 28°. Then 28/80 = 0.35, or 35%.

In other words, only 35% of the fuel required at — 10° will be required for an outside temperature of 42°, for 12 hours during the day. In the same way, only 16.2% of the fuel required for the maximum fuel demand will be required for 12 hours during the night. Then

35% of 80.3 x 12 hours = 337.26 lbs. coal saved per day
16.2% of 80.3 x 12 hours = 156.10 lbs. coal saved per night

Total 493.36 lbs. saved per 24 hours.

Assuming the heating season to be 216 days, 493.36 x 216 = 106,566 lbs., or 53.283 tons of coal saved per season.

SAVING IN RADIATION

The usual figure for radiation is 240 B.T.U. per hour per square foot of radiation. Then, with a total saving of 616,800 B.T.U. per hour, 616,800/240 = 2570 sq. ft. of radiation that can be omitted from the heating system, due to the application of insulation on the roof.

SAVING IN MONEY

53,283 tons of coal at $8.00 per ton*..... $426.26
2570 sq. ft. of radiation at $1.25 per sq. ft. 3212.50

$3638.76

* These unit costs will vary in different localities.

It is to be noted that the saving of $3,212.50 on radiation is an initial saving, while the coal saving is an annual saving.

If the insulation is applied for the saving of heat alone, then the entire applied cost of insulation should be charged against such money savings as calculated above. If, however, the insulation is applied with the sole idea of preventing condensation, as in textile plants, paper mills, etc., then the entire applied cost of the insulation should be charged to the prevention of condensation, and the savings in fuel and radiation would be a net saving.

Commenting on the above method of analysis, some of our best engineers agree that:

"Instead of using a factor of 8 lbs. of steam per pound of coal 7 is better, as there is very little commercial coal nowadays that will run as good as 8. The addition of 10% of the initial saving in radiation may be added to the annual saving in coal, to cover interest, insurance, maintenance, etc."

A subsequent article will consider in detail the problem of preventing condensation under roofs of buildings.

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EVER since the establishment of the National Trade Extension Bureau the question has been present in the minds of heating men as to how far this agency was prepared to devote itself to the interests of the heating and ventilating industry, as distinguished from the plumbing and heating industry. The fact that the bureau is sponsored by the National Association of Master Plumbers would lead naturally to the expectation that the bureau would place most of its emphasis upon that field. At the same time the declaration has been made frequently that the bureau is desirous of serving both industries and has solicited support from heating interests no less than from those representing the plumbing field. As evidence of this interest the bureau has scheduled so-called T.E.B. selling campaigns for the different months of the year of which four can fairly be claimed to be for the benefit of the heating industry namely, the "heat by radiator" campaign, the "hot water for every need" campaign, the "clean-up of previous sales" campaign, and the "automatic heat regulation" campaign. In spite of these activities, it has been apparent that the major efforts of the bureau were and are being devoted to the plumbing field.

To many it has seemed that the bureau was engaged in a studied effort to minimize the divergence which exists between these two industries and which has resulted in segregating in one group the so-called plumbing and heating contractors and, in the other, the heating and ventilating engineers and contractors. It has even appeared to some that those directing the plumbing industry were intent on fostering the popular belief that the two industries were identical and, by that means, really to make them one.

The recent publication by the National Trade Extension Bureau of a "Standardization Course of Training for Apprentice Plumbers" led to the inquiry as to whether this course dealt with heating subjects or, if not, whether the bureau intended to publish a course for apprentice steamfitters. It then appeared that the heating industry as a body had been repeatedly requested to provide financial means whereby text material could be developed by the bureau for the steamfitter. It was proposed that the heating men finance an analysis of the steamfitter's trade to determine the things a fitter needs to do to earn his living and the things he needs to know so that he may perform intelligently the essential jobs of the trade. This analysis is considered fundamental to the writing of a text-book. The second step would be the preparation of the text-book proper. At the same time, it is argued, there should be a nation-wide campaign for better training facilities for fitter apprentices, just as apprenticeship for plumbers have been boosted.

In view of this aspect of the situation, the question arises as to whether the heating industry itself is not to blame for the failure to keep before the public its character as essentially a distinct industry. As was brought out only recently, the fact that a heating man takes a plumbing contract or a plumber takes a heating contract does not in itself make him a combination heating and plumbing contractor, any more than a man who plays tennis and golf becomes a combination tennis and golf player. But if the heating industry is not going to bestir itself in making this fact clear to the public, it will have no one but itself to blame if the present popular misconception of the two industries continues to prevail.

As the case stands at present, the warm-air furnace men have their Publicity Bureau to advance the interests of warm-air furnace heating, the plumbing and heating contractors have their Trade Extension Bureau, but the heating and ventilating engineers and contractors are still without adequate means for presenting and keeping before the public the distinct character of the services they render.

THIS issue contains the first installment of the new Home-Study Course in Steam and Water Heating which will appear regularly in the columns of THE HEATING AND VENTILATING MAGAZINE. It is now estimated that the course will comprise 30 installments. Naturally, in the first installment, it is necessary to refer at some length to certain fundamentals which every heating man must learn before engaging in actual design work. These essentials have been presented as briefly as may be; in fact, a considerable section of the text, intended for men who have had no previous knowledge of the principles of heating and ventilation, does not appear but will be forwarded separately to any student upon request. The main sections of the course will be found intensely practical and will embrace the kind of work being done every day in the leading heating contracting establishments throughout the country.

The Rise of Panel Heating

The extensive use of panel heating in England, which is giving equally satisfactory results in large buildings and private residences, has brought many inquiries from American architects and consulting engineers regarding the practicability of using this system in America.

The first panel equipment of importance was installed in the Royal Liver Building, Pier Head, Liverpool, in 1909, under the supervision of Captain H. Riall Sankey, C. B. R. E., and R. A. Smith, M. I. E. E., consulting engineers, and Aubrey Thomas, F. R. I. B. A., architect. This building was certainly the highest, and at that time probably the largest single block building erected in England.

The success that attended this installation led to the system being adopted at the Midland Adelphi Hotel, Liverpool, the Australian Commonwealth Building, London, the General Electric Building, London, and in a large number of office buildings, department stores, apartment houses and private residences.

Of particular interest to Americans is the Bush Building, Aldwych, London, designed for the Bush Terminal Company by Helmle & Corbett, of New York. This handsome building, which is now one of London's prominent landmarks, is warmed throughout by the panel system.

Two large extensions to University College Hospital, London, and an extension to the Bolingbroke Hospital, London, are also being equipped with this type of heating and in each case the heating units are located in ceilings.

CHARACTERISTIC FEATURES OF PANEL SYSTEM

The panel system employs extensive, moderately-warmed flat surfaces from which radiant heat is diffused to all parts of the room in which the surface is situated. By this method a very small proportion of heat transmission is by convection, whereas with the ordinary radiator the larger proportion of heat diffusion is by convection, the radiant effect being comparatively small.

How the Panel System is Adapted to Heating Corridors
Broken lines show location of extended surfaces behind marble slabs. Note control valves at right.

Liverpool Waterfront, Showing Royal Liver Building (at left) Equipped with Panel Heating System

SYSTEM GENERATES RADIANT HEAT RAYS

It is claimed that where the panel system of heating is employed, comfortable heat conditions can be maintained with a lower air temperature than is usually found necessary, as the occupants of the room, as well as the furniture, walls, floors and other objects, are directly warmed by the heat rays projected from the extended surfaces, the general effect being the same as that produced by exposure to the sun's rays in comparatively cool air. Considerable economy in fuel consumption has been experienced in the buildings in which the system is installed.

The extended surfaces are warmed by the circulation of hot water through small pipes embedded by patented processes in the fabric. In England, the best results have been secured by locating the heating surface in the ceilings, but where necessary or desirable it may be arranged in the walls or in floor margins.

The surface may be finished in plaster or covered with marble, slate, glass or almost any suitable substance which will not be detrimentally affected by moderate heat.

Arrangement of Panel System in Window Casements

This system is the joint property of Richard Crittall & Company, Ltd., and J. Jeffreys & Company, Ltd., of London. J. L. Musgrave, a director of the former firm, made a trip to New York recently to introduce the panel system in America. It is proposed to set up an organization in New York, with branches in other cities, as necessity arises, to explain the merits of the system to intending users, to advise architects and consulting engineers upon the simplest method of applying the system to secure the best results, and to render guidance and assistance to heating contractors during the installation of the system.

In this way the use of the system may not be confined to any particular installing contractor, nor will the advisory organization in any way interfere with the functions of the consulting engineer.

It is hoped that in a few weeks a working installation will be available for inspection in New York City.

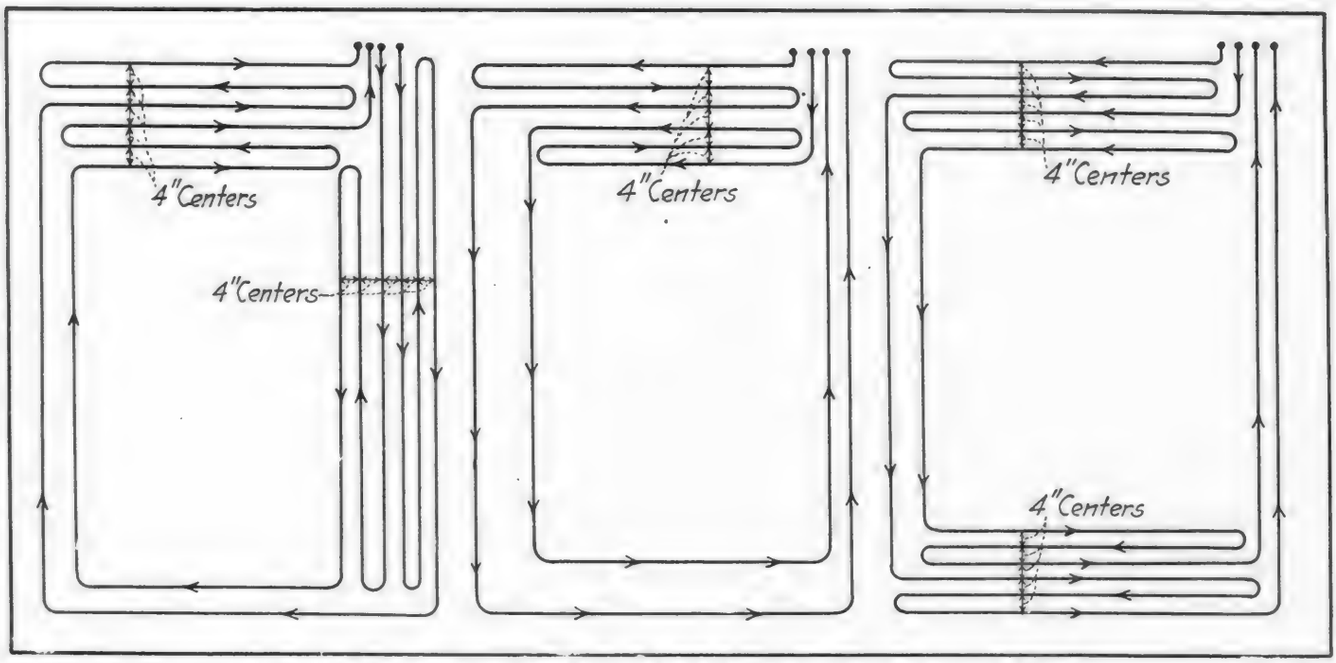
Welding a 1000 Ft. Pipe Line

An ingenious application of electric arc welding was recently made by the master mechanic of the Northwestern Improvement Company at Roslyn, Washington. A 1,000-ft. pipe line was to be constructed.

A number of 4-in. B. & W. boiler tubes had outlived their usefulness and had been consigned to the scrap heap. The pipe line to be constructed called for 4-in. pipe and the boiler tubes were 4 in. outside diameter. Sleeves were cut from 4-in. standard pipe about 4 in. long, into which the ends of the tubes, previously sawed off square, were slipped until they butted together. The ends of the sleeves were then welded solid to the tubes. A General Electric resistor arc welder was utilized.

Another line was constructed of Stirling tubes. These were 3¼ in. outside diameter and nothing was available from which to cut sleeves. The damaged ends were cut off square, one end of each tube was brought to a red heat in a forge and then expanded by driving a mandrel into it about 3 in. The plain end of the next tube was then forced in as far as it would go and welded.

No expansion joints were used, as both lines were to carry water and were to be buried in a ditch. The ditch had a number of bends in its course, and, to avoid the use of flanges the pipe was welded on supports over the ditch



Typical Arrangements of Extended Surfaces in Panel Heating System

nd then bent to conform to the ditch ith a jack and chain, after which it as lowered into place.

Flanges were necessary to connect the pipe to other lines and these were bored smooth on the inside and the tubes expanded into them with a tube roller.

British Heating Engineers Discuss Research, Radiators and Fuel-Oil

A paper on "Research Work: Its Past, Present and Future," by Edgar Herring; one on "Heating Emission from Radiators," by Alcwyn A. Jones; and a third on "Oil Fuel for Central Heating," by A. F. Baillie, were features of the summer meeting of the (British) Institution of Heating and Ventilating Engineers, which was held this year in London to enable the members to visit the British Empire Exhibition.

In his paper on research work, Mr. Herring attributed the great advances and developments in engineering during the last forty years to (1) painstaking inquiry, investigation and research on the part of those who, recognizing the imperfection of existing conditions, sought for the knowledge which was so necessary to improvement, (2) improvements in the design and manufacture of heating appliances; (3) advance in the standard of education among engineers as an outcome of the greater facilities afforded by the modern systems of theoretical and technical instruction, and (4) the publication of a higher class of literature and the free interchange of knowledge and views on matters relating to heating and ventilation.

These factors considered, continued Mr. Herring, there was no doubt the march of progress was due almost entirely to research which, apart from dealing with investigations of a highly scientific character, in the broadest sense embraced all experiments and investigations having for their object some development or improvement in existing appliances or some addition to the knowledge of physical and mechanical properties of everything that goes to the building of the entire structure of the material world.

Mr. Herring went on to tell of the establishment of the Research Department at University College, London, and how it had been able to continue through the grants of the government Department of Scientific and Industrial Research.

The field for research, Mr. Herring continued, is so extensive as to render it imperative that the department be placed on the soundest financial footing and constitute a permanent branch of the institution's activities. It could not be denied, he stated, that it was in the best interests of the industry to investigate, experiment, search and research without intermission. It was a duty they, as members, owed to themselves and the industry to which they belonged.

Mr. Herring concluded his paper with an urgent appeal for support for the Research Department. It was pointed out that an income of at least £600 a year was needed for the research work, and even a larger sum if the scope of the work was to be extended. As the result of his address a new appeal will be sent out to the membership for subscriptions to support the research work.

Mr. Jones's paper on "Heat Emission from Radiators" reviewed the investigations made at University College based on the preliminary investigations of Mr. Kinoshita in which he found that the amount of heat transmitted from radiators, ordinary type, was proportional to the 1.3 power of the temperature itself between the mean temperature of the circulating fluid and of the surrounding air.

Before commencing the latter tests, experiments were made with different flow and return connections. From the figures of about 25 tests made with bottom-bottom and top-bottom connections, it was clearly shown that the top-bottom connection gave 12% more heat than the bottom-bottom connection with the same temperature difference between the radiator and the surrounding air. The emission was found to be exactly the same whether the top-bottom connections were made on the same side or the opposite sides of the radiator. The standard connections made for the tests were top-bottom, same side.

Panel System Effectively Applied to Stairway Wall

It was decided, stated Mr. Jones, to rate the heat emission of the radiators on a B.T.U. basis per section, instead of the present square foot rating which, owing to the great difficulty in measuring the exact surfaces, was considered very misleading, and did not take into consideration the shape and efficiency of the radiators. An effort is being made to have the manufacturers use the B.T.U. basis in their radiator catalogs.

The values include those for K, the co-efficient of heat transmission per section, per degree difference per hour, and also the emission of B.T,U. per section, per 100° difference; the latter being the difference most commonly used in English practice for estimating.

Mr. Jones gave a formula for figuring the number of sections required for heating a room with the difference between the mean radiator temperature and that of the air assumed as 100° as follows:

$$n = \frac{Q}{M}$$

Bush Building, Aldwych, London, Equipped with Panel System

where n = number of sections of a radiator.
Q = heat required in B.T.U. per hour.
M = emission of heat in B.T.U. per section for the temperature difference of 100° per hour.

For calculating the emission for temperature differences other than 100°, the following formula is used:

$$E = K\ n\ t^{1.3}$$

where E = Total heat emitted from radiator in B.T.U. per hour.
K = the constant per section.
n = number of sections of a radiator.
t = temperature difference (water-air).

Tables were included derived from over 300 tests giving the values of K per section of radiator placed free from wall, also the emission in B.T.U. per section for 100° difference, for the product of two typical radiator companies.

Further tests, Mr. Jones stated, are now being made to determine the effect of placing radiators near a wall, with and without shelves over them, and with air flowing at varying velocities over the surfaces.

Mr. Baillie's paper was an authoritative presentation on the subject of fuel-oil heating, Mr. Baillie being connected with Shell-Mex, Ltd.

OIL FUEL FOR HEATING

Among the points made by Mr. Baillie in regard to oil fuel were that the desired temperature was easily attained in the building in shorter time than with solid fuel, that there is a reduction of boilers required for the same work in the ratio of 7 : 5 in the case of cast-iron sectional boilers, and that a longer life may be expected of sectional boilers, due to the fact that no cold air enters the fire door to chill the sections when the fire is being cleaned.

One should consider, said Mr. Baillie, the capital cost of five boilers, oil-fired, against that of seven boilers, coke-fired.

The following figures, giving comparative costs for the winter season of 32 weeks in a northern English town were included, the boiler being a 12-section Ideal type:

	Coke 1921-22	Oil 1923-24
Labor for firing, cleaning, ash-handling, maintenance, etc.	$884.72*	$221.12
Materials for operation and maintenance, being electricity for compressors, etc.		47.56
Fuel cost:		
92 tons coke at $8.56 per ton	787.52	
35 tons oil at $18.60 per ton		651.00
Capital cost oil tank:		
$265.00 at 15%		39.75
Capital cost of installation:		
$1012 (oil) at 15%, say		146.00
	$1672.24	$1105.43
Added to this are the following advantages:		
Space occupied:		
By coke storage	6480 sq. ft.	
By oil storage		3240 sq. ft.
Time taken in heating factory	6¾ hrs.	4½ hrs.

* Figures converted from English units.

THE BEESTON BOILER CO., LTD.

Pattern.	Height in inches.	K. per section. per deg. diff. per hour.	Emission of B. T. U. per section for 100 deg. diff. per hour.
Princess 1-col.	36	1.180	469
	30	0.981	390
2-col.	36	1.510	601
	30	1.251	498
5-col.	36	1.952	777
Window	13	0.807	323
Royal	36	1.280	509
	30	1.081	430

THE NATIONAL RADIATOR CO., LTD.

Classic 4-col.	36	1.180	470
	30	0.993	395
6-col.	36	1.725	687
	30	1.415	565
Plain 1-col.	38	1.130	450
	32	0.973	390
2-col.	38	1.510	600
	32	1.250	500
3-col.	38	1.845	735
4-col.	38	2.535	1010
Classic wall	32	2.715	1080
Ideal wall	22	3.027	1204

The boiler was hand-fired with coke and, when converted to oil firing, was fitted with an air-jet burner, the air being taken from two compressors electrically-driven, with a capacity of 2 cu. ft. per minute each, at a pressure of about 12 lbs. When starting up, an electric heater was used until the water was hot, after which current was cut off from the heater and hot water from the boiler itself served the same purpose. The air pipe was led into the combustion chamber and out again to the burner, thus obtaining a preheat of the air for combustion with beneficial results.

Mr. Baillie endorsed the use of concrete tanks for oil storage provided they have a suitable lining. In some cases, he said, old concrete coal bunkers over the boilers themselves have been lined with an oil-resisting, impenetrable compound and made quite satisfactory.

Where oil burning systems have to be started with no steam available, some means, of course, are necessary to lower the viscosity of the oil for lighting up. One method mentioned by Mr. Baillie was the use of a small vertical boiler fired by kerosene to supply steam for the oil heater and steam jet burners and pump, until sufficient steam was available on the main boiler. Another way of obtaining the necessary heat for the initial heating was to fit an electric heater in the oil line which, with air jet, was a satisfactory method. With steam jet systems, if compressed air was available, that could be used for atomizing without steam, there being burners suitable for this. On the other hand, some burners will start right away without any preheating of the oil which could be at normal atmospheric temperature. Electrical ignition was also mentioned as in use both for starting and for relighting, Mr. Baillie mentioned as a substitute for this an asbestos torch dipped in kerosene.

As announced in these columns last month the Lumby premium of £10 for the best paper on a heating subject was awarded to V. Nekrassoff of Philadelphia. The Sirocco premium, of a like amount, for the best paper on ventilating engineering, was awarded to V. Matthews. The Preston premium of 5 guineas was awarded to H. H. Stirzaker for a paper dealing with safety valves.

Both the annual dinner of the institution at the Langham Hotel and the outing, including a motor drive to Windsor, proved attractive features and were well attended.

Heating and Piping Contractors' National Association has appropriated $500.00 for the Research Laboratory of the American Society of Heating and Ventilating Engineers. The association has also made its usual appropriation to the National Trade Extension Bureau. Two new local associations have been formed in Grand Rapids, Mich., and in Minneapolis, Minn.

American Society of Heating and Ventilating Engineers

Officers Nominated for 1925

Following are the nominations for officers of the American Society of Heating and Ventilating Engineers, as announced by the Nominating Committee of the Society:

For president, L. A. Harding, Buffalo, N. Y.; for first vice-president, William H. Driscoll, New York; for second vice-president, F. Paul Anderson, Pittsburgh, Pa.; for treasurer, Perry West, Newark, N. J. For members of the council: Homer Addams, New York; Willis H. Carrier, Newark, N. J.; Joseph A. Cutler, Chicago; Walter E. Gillham, Kansas City, Mo.; W. T. Jones, Boston; Thornton Lewis, Philadelphia; J. H. Walker, Detroit; and Professor A. C. Willard, Urbana, Ill.

For members of the Committee on Research, which directs the work at the society's Research Laboratory, in Pittsburgh, the nominees are William H. Driscoll, H. M. Hart, C. V. Haynes, J. I. Lyle and Perry West.

Council Meeting Notes

Progress in the movement to establish a standard boiler rating code for low-pressure boilers was reported by S. E. Dibble at the September meeting of the council of the American Society of Heating and Ventilating Engineers. At a recent meeting of the boiler manufacturers held in Pittsburgh, he reported, it was decided to send out circular matter to all boiler manufacturers in the country on the subject of ratings. At a later meeting of the manufacturers, held in Pittsburgh, October 8, plans were made in detail to formulate a boiler rating code. Until a suitable rating code is formulated it is the desire of the various manufacturers to have their boilers tested at the society's Research Laboratory in accordance with the revised Code for Testing Low-Pressure Heating Boilers.

Dr. Paul G. Agnew, secretary of the American Engineering Standards Committee, brought to the attention of the council the difficulties his committee is experiencing on account of the delay in the preparation of a code for exhaust systems sponsored by the society in 1922. He was assured that a committee would be at work on the subject and would present its findings as shortly as possible. The matter of the sponsorship by the society of the proposed Ventilation Code was also discussed and it was suggested that the A. E. S. C. wait until after the society's next annual meeting when it was hoped the report of the society's committee of Code on Heating and Ventilation would be in shape for adoption.

The Guide Publication Committee was reappointed for the coming year with Perry West, chairman, the other members being J. E. Bolling, C. E. Eveleth, E. S. Hallett, L. A. Harding, C. V. Haynes, F. D. Mensing, J. F. McIntire, L. C. Soule and A. C. Willard.

Opening Meeting of Western New York Chapter

Fifty members and guests were in attendance at the opening meeting for the season of the Western New York Chapter, held October 6, at the Hotel Lafayette. After outlining the plans for the year, President Hutzel introduced M. J. Biern, who spoke on "General Business Conditions." Mr. Biern recalled how closely his prophecy made at the chapter's April meeting last year had been fulfilled. He then called attention to reports showing improvement of agricultural conditions, increased railroad contracts, as well as increased mail order sales and retail buying. European conditions, he said, are becoming more stabilized and during the past month building permits and contracts awarded are on the increase.

The technical address of the evening was given by J. F. McIntire, vice-president of the United States Radiator Corporation, Detroit, Mich. Mr. McIntire's subject was "Rating of Low-Pressure Heating Boilers."

Rating, said Mr. McIntire, is a numerical value of capacity obtained arbitrarily by certain fixed conditions. The maximum capacity of a boiler is limited by its priming point and the draft available. It would seem that the rating should not exceed 85% of the capacity which can be developed without priming.

The capacity, continued Mr. McIntire, increases with the increase of draft or, expressed differently, with the increase in rate of combustion. Therefore, to establish a method of arbitrarily fixing rating, it becomes necessary to establish a method of limiting the rate of combustion. The limit to pounds of coal burned per square foot of grate per hour is not practical, due to its tendency to limit design.

Stack area and height cannot be depended upon as a satisfactory limited factor, due to fluctuations in draft available under varying climatic conditions. Draft available in inches of water at the smoke-hood would be much more satisfactory. The temperature at the smoke-hood bears a relation to rate of combustion and might be used as one of the limiting factors.

It is generally agreed, concluded Mr. McIntire, that boiler manufacturers, in listing their ratings, should specify the heat available at the boiler outlets per hour, fuel-carrying capacity, the kind, size, heat value of the fuel, amount consumed per hour, weight of stack gases and draft in inches of water.

Following Mr. McIntire's talk, there was a considerable discussion, those participating including L. A. Harding, C. A. Sawade, C. H. Flink and President Hutzel.

Among the out-of-town guests at the meeting were R. H. Linn, industrial engineer for the American Radiator Company; L. C. Soule, engineer of the Aerofin Corporation; and Carl Sawade of the Continental Heater Corporation.

New Officers of Wisconsin Chapter

At the September meeting of the Wisconsin Chapter of the American Society of Heating and Ventilating Engineers, the following officers were elected:

President, F. E. Downey; vice-president, W. Gunton; treasurer, W. H. Wilson; secretary, C. J. Rice. Board of governors: Edmund Grassler, C. W. Miller and Professor G. L. Larsen.

Kansas City Chapter

At the opening meeting of the Kansas City Chapter, held September 11, in Kansas City, a surplus was reported from the semi-annual meeting financing. This surplus was turned over to the society's Research Laboratory, while both J. H. Kitchen, general chairman, and E. K. Campbell, chairman of the finance committee in connection with the society's summer meeting, were rendered votes of thanks for their efficient work in that connection. New members elected to the chapter are: C. D. Edlund, C. H. Carr, Raymond Bidwell, T. E. Worthington and D. H. Painter.

Toronto Chapter Holds its Inaugural Meeting

With a membership of over 50, the Toronto Chapter of the American Society of Heating and Ventilating Engineers held its inaugural meeting of the season, October 6, at the Hotel Mossop, Toronto. After a chicken dinner, President A. S. Leitch introduced the subject of the evening, which was the suitability of various types of boilers as applied to schools and other institutional buildings. The speakers included R. W. McHenry, who dealt with cast-iron sectional boilers; T. Worthington, of the Dominion Kewanee Boiler Corporation, who discussed fire-box boilers; H. H. Angus, who covered water-tube boilers; and N. Quesnell, whose talk was devoted to horizontal return-tubular boilers.

Officers elected are as follows: Presi-

dent, A. S. Leitch; vice-president, H. R. Flett, Taylor-Forbes Co.; treasurer, H. J. Church; secretary, W. R. Blackhall.

During the winter it is planned to hold monthly meetings of the chapter the first Monday of each month. The subject for the November meeting, held November 3, was "Stokers and Oil Burners."

Annual Meeting of Illinois Chapter

Election of officers and a discussion of the proposed Code on Heating and Ventilation which the society is formulating, were the principal features of the first meeting of the Illinois Chapter since May. The members met at the Engineers' Club, October 13, where dinner was served preceding the business session.

The committee appointed to co-operate with the city director of the local ordinance on ventilation to effect a more efficient code, reported a temporary delay in its work due to a change in the director's office. H. M. Hart urged that the work be pushed and that the co-operation be secured of the master steam fitters and architects, as well as the real estate boards, with a view of providing Chicago with the best ventilating code that could be drafted. A motion to this effect was passed.

Announcement of the election of new officers was made by T. C. Douglass, as follows:

President, Homer R. Linn; vice-president, A. B. Martin; secretary, H. G. Thomas; treasurer, August Kehm. J. A. Cutler was elected a member of the board of governors.

Mr. Linn, upon taking the chair, made a brief address in which he expressed the anticipation of new and constructive work to be accomplished by the chapter this winter.

Discussion of the society's proposed Code on Heating and Ventilation was the next order of business. Committees had already been appointed on various sections of the code to make their recommendations on the respective sections.

Chairman Small, who discussed Section 1 (definition of terms in common use as applied to heating and ventilation), said he had no criticisms or recommendations to make. After some discussion led by Dr. E. Vernon Hill and H. M. Hart, President Linn suggested that the committee take into consideration the points raised in the discussion and report back later.

Chairman Jones of the committee on Section 3 (minimum requirements for estimating the heat required to warm buildings) thought care should be taken not to act too hastily in preparing a national code dealing with this subject. He urged the separation of the code matter and text-book matter.

Chairman R. G. Rosenbach, of the committee on Sections 4 and 5 (minimum requirements for the determination of the amount of radiation to be installed in heating systems and of indirect radiation to be installed in indirect systems) submitting a typewritten recommendation embodying changes which were approved by the meeting. Upon motion, it was agreed to send Chairman Rosenbach's recommendations to the code committee of the society.

It was also decided to call a special meeting of the chapter, October 27, to discuss the code further.

New members elected at the October meeting are J. C. Matchett, Illinois Engineering Co.; F. H. Stevens, Heggie Simplex Boiler Co.; and David H. Cuyler, Pierce, Butler & Pierce Mfg. Corp.

New York Chapter Discusses Ozone at Opening Meeting

A talk on ozone, with special reference to its use in the industrial field and in ventilating work, delivered by Frank E. Hartman, Ch. E., engineer for the United States Ozone Co., Scottdale, Pa., was the feature of the opening meeting of the New York Chapter, held October 20, at the Building Trades Club, New York. Mr. Hartman elaborated on his address at the recent midsummer meeting of the American Society of Heating Engineers, in Kansas City, Mo., stressing the necessity of dry air as a prerequisite in ozonizing work. Dust and gases were also to be avoided. Mr. Hartman told of the material used to produce dry air in the machines made by his company, known as porolight.

Among the important uses of ozone Mr. Hartman mentioned its effectiveness in the sanitation of swimming pools. The speaker referred to Nature's process of purifying the air which, he said, was based on the principle of recirculation.

For ventilation work, Mr. Hartman said the importance of having dry air passing the dielectric was now generally conceded and all of the new types of ozone machines will have this feature.

In the discussion F. R. Still emphasized the statement which had been made that ozone will not destroy the germs in room air with the concentrations possible in this work. He said the only effective way to destroy germs by ozone would be to admit heavy concentrations of it during periods of unoccupancy. Mr. Hartman stated that while ozone could not be considered a germ destroyer in room ventilation, it was at least a destroyer of odors and notably effective in imparting "freshness" to the air. This brought up the question of the removal of bacteria with air washers and destroying them by ozonizing the water in the washers. Mr. Hartman stated that this was quite feasible and offered a very good line to work on.

The meeting was opened by President William J. Olvany, who, it came out during the meeting, is a brother of the new leader of Tammany Hall, in New York. Mr. Olvany turned the meeting over to Felix A. Adler who introduced the speakers.

Before the main speaker of the evening was announced Mr. Adler called upon J. L. Musgrave, director of Messrs. Richard Crittall & Co., Ltd., of London, England, who described the Panel system of heating, which Mr. Musgrave is introducing in America. A description of the system is published elsewhere in this issue.

Among the out-of-town guests of the chapter was Dr. E. Vernon Hill, of Chicago, who brought the greetings of the Illinois Chapter and who also participated in the discussion of Mr. Hartman's paper.

Eighty-five members and guests were in attendance.

Lawrence C. Soule, secretary of the Aerofin Corporation, Newark, N. J., was the principal speaker at the opening meeting for the season of the Massachusetts Chapter. Mr. Soule's subject was "Aerofin Radiation," and his talk was accompanied by lantern slides.

Features of University of Illnois' Short Course in Plumbing and Heating

University of Illinois's short course in plumbing and heating, which went on from September 15 to September 20, was taken by 45 men, including a number of manufacturers' representatives. Two branches were studied, hydraulics and mechanics. Instruction in hydraulic engineering was conducted by Professor H. E. Babbitt, while the mechanical engineering division was in charge of Professor A. C. Willard.

Among the demonstrations given was one of apparatus for measuring the friction or pressure loss of water flowing through straight pipes, elbows, tees and valves. Another showed the causes and cure of water hammer. Still another was in the form of a test to illustrate conduction, radiation and convection, as well as window leakage.

Methods of calculating heat losses from buildings were explained, and the heating effects demonstrated of the different types of radiators in common use. Of particular interest was a demonstration of the savings effected by covering steam piping.

What happens in a boiler when generating steam was graphically presented through the use of a glass bull's eye in front of the boiler and a light in the steam space by which it was possible to see the steam separation from the water at the water-line. Another set-up for use in determining the loss in pressure due to friction with various rates of steam flow through pipes, was operated as connected to a one-pipe system, and illustrated the effect of the flow of condensation on the flow of steam. An explanation was given of the way to determine the amount and velocity of steam flow.

As in the previous course, a test was made of a simple water heating system, consisting of a flow and return riser connected to a water radiator. A

portion of the riser was made of glass. While the system was in operation, measurements were made of the heat given off by the radiator and of the weight of water flowing through the system.

The Corbels on the American Radiator Company's Building

Architectural circles in New York, according to the *New York Herald-Tribune*, are buzzing over a series of stone plaques, or corbels, imbedded in the facade of the new American Radiator Building, at 40 West 40th Street, New York. Human figures are cut in six of the nine corbels. The corbel at the extreme right, it is maintained, bears a distinct resemblance to an American eagle.

Although cut in yellow stone, the "eagle" appeared to the eyes of some architects to have a downright blue-nosed beak. Raymond H. Hood, architect of the building, in discussing the matter, declared that all of the corbels are intended to represent heat. The so-called "eagle," he declares, is in reality a phoenix. Being a legendary character, it is presumed to be entitled to a blue nose or any other color nose, for that matter.

In explaining the various corbels on the building, the architect stated that the first was a salamander, expressing fire. The second shows a leering old toper with a wine jug, indicating the heat generated by wine. The third is a fierce masculine figure symbolizing the fire of hatred. The fourth is a female figure indicating physical love. No. 5 represents a man tugging at the chains of labor, thus inducing muscular energy and heat. No. 6, a female figure with an intense facial expression, aims to express fury, also a form of heat. The seventh corbel, a suffering woman, represents the fires of fever. No. 8 is a fire-breathing griffin and No. 9, as stated, a phoenix which rose out of the ashes, like a flame.

Why Priming and Foaming Occur in Heating Systems More Often Than Formerly

Some engineers claim that we have more priming and foaming in present-day boilers than in earlier types. They are apt to attribute the cause of the trouble to this or that method now used in modern heating systems. It is probable, however, that the make or kind of heating system has nothing to do with it.

An unsteady water-line may come about through any number of contributing factors which a few years ago were unknown. We cannot have a general lowering of standards all along the line, yet be free from troubles. Manufacturers dip their pipe in crude oil to preserve it. Manufacturers of radiators use a binder of fish oil for their core sand which makes it adhere longer, so that a boiler may be cleaned out, yet the core sand will keep coming and numerous cleanings are required before conditions are finally satisfactory.

The contractor is anxious to get on the job and just as anxious to get away. He cleans out the boiler—it works for a time and he is through. Next, the pipe fitter finds it easier to swab the female end of a pipe than to go around the male end and far easier to pick up an ell or other fitting than to pick up a length of pipe. He is content to dip a paint brush in the pail, not even taking the trouble to wipe the brush off on the side of the pail before applying the paint. It is a fearless contractor or engineer who tries to enforce the specifications in these days.

Furthermore, some contractors were more careful in the days when there was not so much money to be made. Pipes were reamed then and radiators were not left piled against heaps of sand or otherwise left unprotected as they now are in many cases.

A Device For Locating Pipes in Walls

No longer will it be necessary to guess at the location of pipes, wires or beams within walls or floors of buildings, if the device developed by the General Electric Company, of Schenectady, N. Y., meets the expectations of its designers. This device, which has been developed in the research laboratory of the company, is a portable X-ray outfit which makes it possible to see within and through walls. With its use, it is stated, the location of elbows in pipes, main rafters and wire connections becomes an easy matter. The new equipment, which was developed by Dr. W. P. Coolidge and his associates, weighs 20 lbs., can be carried with ease, and is described as far from fragile.

All of the equipment is mounted on a small wooden carrying case. The X-ray generating unit, with its compactness, ease of manipulation, and freedom from external electrostatic field, is well adapted for special uses in the heating and ventilating industry.

Portable X-Ray Outfit

Experimenting with Portable X-Ray Outfit

To place the device in operation it is only necessary to connect an ordinary extension cord to the nearest socket of the house circuit. X-rays are then produced by pressing the switch. There is no high-voltage hazard, it is stated, since the outfit is grounded to the container.

American Construction Council on the Building Situation

"There is a growing insistence on the part of the building-investing and home-owning public for better quality of construction and greater responsibility in financing and in other phases of building operations."

This statement of Franklin D. Roosevelt's is an excerpt from the semi-annual report of the American Construction Council of which he is president. In commenting on general building conditions, he stressed the fact that though construction is not actually on a stable basis, "a more favorable trend than has existed for the past several years is indicated in this regard both by the volume and type of new work coming out."

Signs indicate that there is a general movement afoot to take advantage of the relative slack in materials and labor during the Fall and Winter months. The slowing down in speculative building has aided this and combined to give a stabilizing influence to the season. Contracts for industrial building have showed an increase, indicating a greater confidence on the part of business generally and particularly in its willingness to invest in buildings for its own use.

As a general survey of conditions in the construction field the Council makes these recommendations:

1. Take specific steps to eradicate the evils arising out of the large percentage of construction of inferior quality and unsound financing.

2. Give serious consideration to the scheduling as far ahead as possible in order to take advantage of slack in material and labor demands.

3. Encourage and extend building congresses and organize new ones

where needed. Local get-together associations are essential in the work of bringing conditions in the industry to the attention of the public and securing the adoption of measures to eliminate undesirable conditions.

Correspondence

Backing Up of Water in Air Line Returns

EDITOR HEATING AND VENTILATING MAGAZINE:

Attached you will find a sketch showing the location of a house-heating boiler. From this boiler, carried along the basement, are two mains, one long main 2½ in. in diameter and one short main, 2 in. in diameter. The reason for this arrangement of piping was to provide a short main to the living room and dining room for quick circulation in heating. Each radiator is piped on the return end with an air vent, then through a ½ in. air-line return and all these are carried down to the turn in the boiler, with a check valve in each line. The elevation in the sketch shows the check valve in a different plane. This is to better indicate the position of the pipes, but as a matter of fact, these pipes, together with the check valve, are located in the same horizontal plane.

There is limited headroom in the basement, hence the air vents on the top of each main coming back, as well as the airvent line, are up against the ceiling and there is but 2 ft. between the water-line of the boiler and the center-line of each main coming back to same.

Now the problem is, when the pressure builds up to about 2 lbs. water builds up in the pipe marked "B," which is the air-line return pipe and discharges through the vent "A," and as the pressure continues to build up, water from the boiler is discharged here, and it has taken the water down considerably below the water-line. If it is within the scope of your service and information, I would thank you to advise me the reason why this happens.

Cleveland, O. T. W. A.

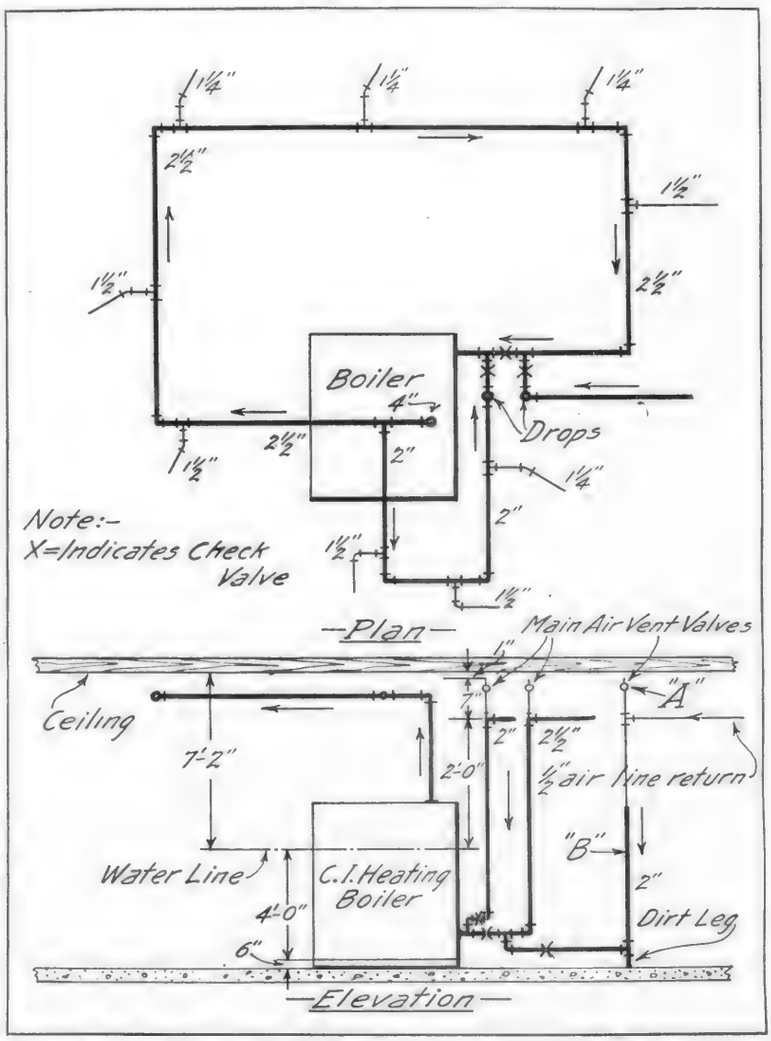
When a heating system is started up, such as the one shown in the sketch, steam enters the system and passing through the pipes drives the air ahead of it out through the radiator air-line valves and into the air-line return. From this point it is in turn expelled through the main air-vent valve. This valve is located near the boiler at the point "A" where the air-line return drops below the water-line.

Now as the steam reaches the thermostatic members of the radiator air-line valves they automatically operate so as to close the ports of these valves and prevent the passage of steam, so that this end of the air-line return is then sealed or closed, though the other end is open to the atmosphere through the main air-vent valve at "A." Meanwhile steam is passing through the radiators, thence back through the other two mains to the other two main air-vent valves.

The pressure of this steam by the time it nears the boiler has become slightly lowered due to the friction of its run, say from 5 lbs. to 4½ lbs. So if we have 5 lbs. steam pressure in the boiler tending to force its way into the supply piping and also because of its pressure on the water in the boiler tending to force the water back into the returns, we have a difference in pressure tending to back up the water of only ½ lb. As a consequence, the static head or downward pressure of the water in the 2 ft. vertical rise in the returns is greater than this differential pressure so that water does not back up into the two main horizontal returns.

As every pound of pressure differential will raise the water in the return drops approximately 28 in., so the assumed ½ lb. of pressure differential will raise the water only 14 in., after which any additional condensation from the radiators will flow into the boiler as fast as it is received in the returns. But in the case of the air-line return the pressure differential is much greater. This line is open through the main air vent valve to the atmosphere, hence the pressure differential is 5 lbs., and, as a consequence, water from the boiler is backed up into this main.

Of course with check valves on these lines working properly water cannot be backed up, but it can be retained or held up. However, a leaky check valve will allow it to back up and this must be the trouble in the case submitted for there should be but little condensation in the air-line return, that is, providing radiator air-line valves are functioning properly so as to prevent the passage of steam. This explains why water was lifted or held up, as the case may be, and then discharged through the particular vent valve mentioned. Now the



How an Air-Line Return was Wrongly Connected to Boiler, Instead of Terminating with Open End

emedy is to run the air-line return, just as is always done, to some convenient point such as a sink, terminating it with open end for visible and unrestricted discharge. As now run it is indeed novel and original.

The installation further errs in the use of a main vent valve at "A." Such a valve, or for that matter any valve, is unnecessary with an air-line return and is harmful due to its small port (1/16 in.) for air discharge. It should also be pointed out that had the 2-in. pipe at "B" been carried up to "A" there would be much more volume in the pipe for the storage of water in its building up to the point of troublesome discharge at "A," as the condensation entering the air-line return is or should be but very slight in amount. Incidentally, as the piping is now arranged the return of the air-line must pass through two check valves before entering the boiler.

Still another point is that the size of the main air-line return is rather small—1 in. pipe would have been better, for as the system ages, interior corrosion and mechanical injury are hard on such small pipe sizes, particularly where there is no positive means of air line exhaust, as would be obtained with a pump.

New York T. W. REYNOLDS.

Operation of Thermostatic Traps on Radiators

EDITOR HEATING AND VENTILATING MAGAZINE:

On page 69 of THE HEATING AND VENTILATING MAGAZINE for September, H. C. Russell assumes that when a vacuum is extended into the radiator there will be a large amount of steam passed through the thermostatic traps.

Tests have been made in Detroit several times and in each case substantial savings have been effected by carrying as high a vacuum possible in the radiator and still maintain the proper temperature in the building. A chart showing the steam consumption per day while operating under various pressures and vacuums is shown in Fig. 1. The points shown are averages for periods of about five days each. During these tests recording gauges were installed to check the differential pressure across the radiator traps and the leakage was carefully watched for, but no appreciable amount of vapor was noted, even at the highest vacuums.

The discharge from the system was pumped directly to an open tank and through the meter which was open to atmosphere. If there had been any steam leakage it would have presented itself in the form of vapor at the meter. There was absolutely no vapor noticed even when vacuums of 21 in. of mercury were maintained.

The pressure drop through the radiator trap can be kept as low as desired which insures better operation of the trap. Fig. 2 shows diagrammatically the pressure drop through a vacuum system. The upper curve shows the condition with 5 lbs. pressure at the reducing valve and 12 in. of vacuum at the pump. This curve indicates the usual operation of a vacuum system. A high pressure drop across the trap results; which is apt to cause wire-drawing of the traps and, ultimately, continuously leaking traps. The middle curve has atmospheric pressures at the reducing valve and 12 in. at the pump. Here the same condition applies and causes excessive leakage at the traps. The lower curve, having 10 in. vacuum at the reducing valve and 12 in. vacuum at the pump is typical of the conditions under which the tests were made. Here, according to Mr. Russell's statement, the traps are continuously open. Theoretically perhaps they are; practically we do not believe they are, as we have never been able to find the vapor which escapes them, even by opening the line at the discharge of the trap.

The reason that certain traps operate so well under a vacuum may be due to the lower pressure surrounding the thermostatic element which would tend to create a similar pressure differential between the liquid in the thermostatic element and the pressure in the radiator under all degrees of vacuum and pressure. This liquid may not have exactly the same characteristics as steam, yet the low pressure drop across the trap requires only a very light seating to stop the steam flow.

The small difference in pressure for a line 800 ft. long, discussed in Mr. Russell's article, does not indicate leakage through the traps, but indicates no drop through them when they are open and no flow through them when they are closed.

J. EARL SEITER.

Detroit, Mich.

Whistling Noise in Gas Burners

EDITOR HEATING AND VENTILATING MAGAZINE:

I have a gas-fired boiler hot water heating installation supplying about 500 sq. ft. of radiation. The piping and boiler connections are in accordance with standard practice. Whenever the room thermostat shuts off the gas, regardless of whether the water temperature at boiler is 140° or 200° F., about one-half minute after it shuts off, there is a very distinct whistling sound like air escaping rapidly from an auto tire when the air valve is opened. This continues for about one-half minute, then stops for a short interval and repeats. It does this about three times and then quits.

This noise, which is very annoying, did not occur until after the installation was in use about six weeks. I drained the system, thinking it might be caused by sediment at the return connection to the boiler. After doing this, there was no repetition of the noise for three days, when it started again.

Portland, Ore. A. F.

Readers who have experienced difficulties similar to those described by our correspondent and who have found the cause and remedy for them, are invited to pass along their solution for

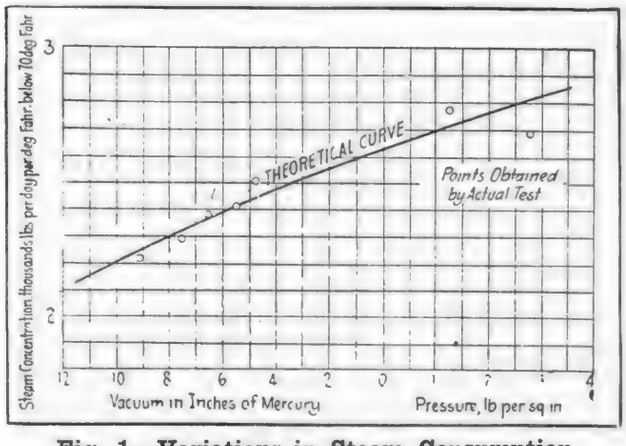


Fig. 1—Variations in Steam Consumption for Various Pressures and Vacuums at Reducing Valve

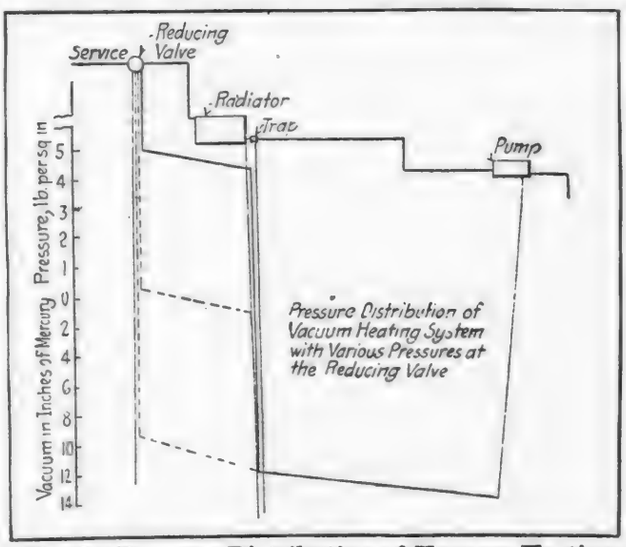
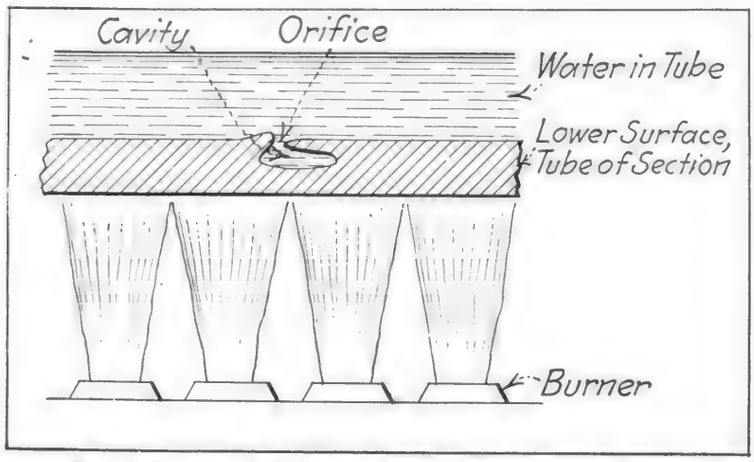


Fig. 2—Pressure Distribution of Vacuum Heating System with Various Pressures at Reducing Valve

the benefit of our correspondent and any others who may have experienced the whistling noise referred to in the operation of a gas-fired boiler, thermostatically operated.

In a case of this sort, which came to the writer's attention, it was decided that the noise was due primarily to the presence of a small cavity in one of the section castings. Of course, this cavity could not be seen, but no other explanation seemed logical.



Cavity in Boiler Section which was Probable Cause of Whistling Noise in Gas-Heated Boiler

Apparently this cavity had a very small opening into the interior of one of the boiler tubes. When the system was first started it would be filled with water. As the boiler became heated this water would be turned to steam and forced out through the small orifice. As soon as the burners were shut off, the steam in the cavity would condense and a small amount of water would be turned into the cavity. Because the casting was still hot, this small quantity of water would immediately be turned into steam which would again discharge into the water, producing the whistling noise. The noise was repeated, apparently, until the casting cooled below the point where steam was produced when water came in contact with it.

After several experiments in turning off burners under the individual sections, it was believed that the section containing the cavity had been located. The results were not entirely conclusive, however, and it was suggested that the entire battery of sections be replaced with new ones, in order to insure the elimination of the trouble. If this is done, it will be possible to tell if the hypothesis here mentioned is correct.

Comparative Costs and Heat Emission for Cast-Iron Direct Radiation

In connection with the article appearing in the October issue which included a number of tables giving the comparative costs and heat emission for various types of cast-iron direct radiation, mention was made of a table of conversion factors for use in obtaining data for other steam or room temperatures than those given. This conversion table, it should be stated, is the one prepared by the late John R. Allen and published in the A.S.H. & V.E. Guide. It also appears as Standard Heating and Ventilating Data Sheet No. 13-TT, published by The Heating and Ventilating Magazine.

How Steam Waste Was Stopped in a Toledo Factory Building

Some interesting details of the savings effected by metering the steam used in a large factory building are given in a report by L. M. Garry, manager of the Toledo Factories Building, Toledo, O. In this building six flow meters were installed to measure the quantity of steam used by various tenants and so determine the monthly charge for steam. The factory building is four stories high, a block long and half a block wide. It is so constructed that it can be occupied by a number of different manufacturing companies and is equipped with modern facilities for manufacturing.

The steam furnished for heating purposes is included in the rent. But the steam supplied for process purposes is billed to each tenant each month, according to the amount used. There are two 250 H. P. boilers; but they are seldom operated together except during the severe winter months.

The load condition on the boiler varies greatly. For example, one tenant operates an electro type machine, another a chewing-gum factory, and another a special labeling machine. Naturally if only one of these tenants uses his machines, the load will be low; but if they all start up their machines at once, the load will go way up.

Until flow meters were installed there was no way of knowing how much steam the different tenants were using, and consequently the charges had to be made on each man's estimate of what he thought he used. As a result, the boiler room was a big expense, both in operating cost and fuel cost.

METERS QUICKLY FIND LEAKS

To over these conditions, six flow meters of the Republic type were installed in 1920. One is used as a totalizer, to measure the total amount of steam produced and furnish a card record of it. The others measure the amount used by the individual tenants.

There is an integrator for each meter body, but only one recorder. This is connected to first one meter and then another as desired. It is not absolutely necessary to record the daily variations, the total amount consumed being the important point.

As soon as the meters were installed the quantity of steam produced was checked against the coal used, as all of the coal is weighed; and also the quantity used by each tenant was checked.

The engineer discovered that one tenant was using from 4,000 to 6,000 lbs. of steam a day. As he was exhausting the steam instead of returning the condensate to the system, this, of course, meant a considerable increase in the coal consumption of the boiler.

SAVING $1000 A YEAR

In another case it was found a tenant was being charged only $1.50 a day for steam, while actually supplying steam to the amount of $3.00 a day. 1000 lbs. of steam a day were also being lost because the pipes were not covered.

There was a general tendency among the tenants to waste steam; and before there was a check on them they would often leave the steam on after five o'clock. Sometimes they would work at night; and then, in order to keep up the load, it was necessary to keep a licensed engineer in the boiler room at night.

In comparing present charges with those made before the meters were put in, and with practically the same load conditions, it was found that a saving of at least $1,000.00 a year was made by being able to charge for all the steam used.

No attempt is made to make a profit on this steam; but it is necessary to charge enough to cover the operating expenses and the depreciation on the equipment. The present rate varies between $1.25 and $1.90 per 1,000 lbs., depending on the price of coal.

As the tenants now know that they will be charged for every pound of steam consumed, they are more careful in their use of it. Now at five o'clock the meter drops at once.

Meter equipment is estimated as having 20 years' life, and $25.00 a year is allowed for maintenance and repairs. The meters require practically no attention, and one-half hour a day is found ample to allow for labor. The power required per meter averages about 25 watts.

The total cost of operating the six meters is $1.46 per day for the 365 days a year they are in use. The cost per day is $.2131.

THE STATE OF BUSINESS

More Signs of Improvement

Foreign Agricultural Markets Important Factor. No Inflation Indicated

Especially Prepared for the THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn Schmidt

SIGNS multiply that the recent improvement in the general situation of the market is not merely a passing flurry but is caused by a nation-wide buying movement, which will become stronger as the season progresses. This all supports our original contention that the depression of this Spring and Summer was to be of short duration only, and that it would end as soon as the farmer was enabled to spend more freely than he had during the past ten months or so.

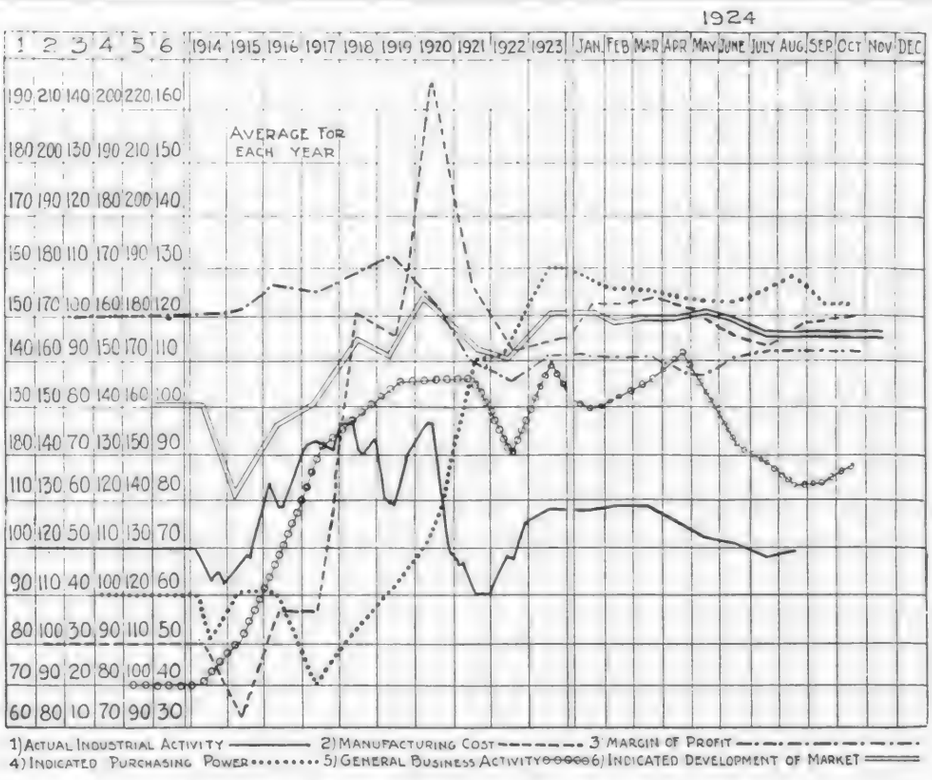
Notwithstanding our comparatively large exports the American nation is not an export country. Unlike European countries we have failed to build up regular export markets upon which we can rely in case of a failing of our own market. There exists no foreign safety valve, to take care of an industrial surplus if the pressure of merchandise gets too great in the domestic market. As a result, our domestic manufacturer stands and falls with a market which unfortunately is governed by factors over which he himself has little or no control.

In fact the domestic industrial prosperity for our non-exporting industrial producer depends upon the chance of his consumer's finding a foreign good-paying market for the products of his labor. Hence American industry will do well if good prices can be obtained abroad for American foodstuffs and if the export movement of foodstuffs is large. Certainly a peculiar situation for a nation, which ranks first among the industrial producers of the world.

But it explains why the settlement of Europe's economic difficulties, resulting from the adoption of the Dawes Plan, has such a significance for economic conditions in this country. Europe, and especially Germany, will now buy more freely such agricultural products as we can offer, foodstuffs and raw materials. By doing so it will provide that surplus demand for these articles which is necessary to turn, will increase his own purchases, giving another turn to the wheel and getting into normal operation the machinery of national prosperity.

Naturally action and counteraction, cause and result, require time to develop. Advancing prices of wheat and other agricultural products already point the way. But rising prices alone do not lead to increased purchasing power. It is up to the banks, by setting in motion the necessary credit machinery, to make effective the benefits of higher agricultural earnings. The agricultural credit situation, therefore, is closely related to the rural purchasing ability during the next few months.

Luckily for everybody concerned the


1924
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JAN. FEB MAR APR MAY JUNE JULY AUG. SEP. OCT NOV DEC
AVERAGE FOR EACH YEAR
1) ACTUAL INDUSTRIAL ACTIVITY
2) MANUFACTURING COST
3) MARGIN OF PROFIT
4) INDICATED PURCHASING POWER
5) GENERAL BUSINESS ACTIVITY
6) INDICATED DEVELOPMENT OF MARKET

Analysis of Business Conditions at End of October

banks have followed a very careful credit policy all through this year. By doing so they are now able to take up the "slack" in the produce movement and to finance not only the farmer's seeding requirements of the coming year, but, what is more important, his immediate purchases. The rising prices for agricultural produce in this manner have not strained the flow of credit, which might easily have been the result, but, on the contrary, will help to increase the purchasing capacity of the nation.

That this increase in purchasing power has not resulted in a sudden pressure of orders upon our manufacturers has its cause in a peculiar change in the merchandising policy of the retailer. There was a time when the salesman was the largest power in American distribution. He still holds a very enviable position but his abilities are now matched against those of the professional buyer and the merchandising man. If the recent depression has produced any lesson, it is that the store carrying least overweight in the way of surplus stock is best able to resist economic pressure. Contrary to former experience the retail trade has come through this year well and this is due entirely to the conservative merchandising methods now adopted by most retailers. Keen observers already have pointed out that the practice of small orders, often repeated and greatly diversified, will be the characteristic of future retail buying. It has been found to be more pliable, less risky and more easy to finance than the former policy of making large contracts upon long-term deliveries.

Manufacturers who were at first puzzled by this new development have in the meantime adjusted themselves to its existence, finding that it has also many advantages from their point of view. The principal one is the practically total absence of cancellations. If one considers the loss resulting to manufacturers and jobbers from this source alone one will see the gain resulting from this change in merchandising habit. Another is the lessening of the credit risk as merchants have been able to make payments regularly all through the tight period, with a noticeable decline in commercial mortality.

All this makes the immediate outlook rather hopeful and manufacturers and distributors should not be disheartened because October has not brought at once all the fruits of ultimate success. No adjustment can take place without slight setbacks until the extent of the economic strength supporting the market has been fully disclosed. This, according to our estimate, should be very extensive, with a general recovery due late this, or early next, year.

The warning cry of impending inflation has been raised again, as was the case two years ago when the country shook off the economic depression, following the war boom. There is nothing in the present situation to cause misgivings, and a curtailment of commercial credits upon a false alarm of inflation certainly would do more harm than good at this juncture of the development of the market.

Meeting of Trade Paper Editors with Officials of Heating Contractors' Association

Acting upon an invitation extended by Henry B. Gombers, secretary of the Heating and Piping Contractors' National Association, a number of editors of trade and technical papers connected with the heating field, met at the headquarters of the association, October 1, to discuss matters of mutual interest. Among the trade paper editors present were William Lawler, of the *National Plumbing and Heating News;* R. H. Bookhout and J. E. Ramage, of *Heating and Sanitary Engineering*, T. N. Thomson and Harold Heatherton of the *Plumbers' Trade Journal*, J. McCormick, of the *Merchant Plumber and Fitter*, and A. S. Armagnac, of THE HEATING AND VENTILATING MAGAZINE

Mr. Gombers reviewed the recent activities of the association in connection with the publication of its Engineering Standards and told of the ambitious program outlined by the Standardization Committee for its future work. He also told of the association's efforts to maintain the distinction between heating and plumbing as separate and distinct industries. While a heating contractor may frequently undertake plumbing work, and vice versa, this, he held, does not constitute a combination of the two industries any more than the playing of two separate games in the sporting field would make one a combination player.

In response to a question as to the progress of the association's apprenticeship program, it was explained that the situation in many of the cities makes it difficult to further this work, as the unions in many places are advocating sharp limitations in the number of apprentices to be employed. At the same time, local employers organizations at various points are being urged to promote apprenticeship training.

Certified heating, it was reported, by which a local association guarantees the successful operation of a heating system installed by any one of its members, has made substantial progress and is now being practised in a number of cities, notably Brooklyn and St. Louis. As is well known, the scheme is to have each member's plans checked by the association's heating engineer before work proceeds on the installation. This practice is not only having a good effect on the contractors themselves, but is being welcomed by the builders who feel that they are being properly protected in securing adequate heating plants.

An amusing incident was related by Mr. Gombers in connection with the radiation tables drawn up by the association in connection with its "Engineering Standards." When the New York table was finished, Mr. Gombers and the assistant secretary, Mr. Fitts, started to figure the secretary's office to see if the proper amount of radiation had been installed. No matter how they figured, however, the radiation was found to be woefully short. Could the table be wrong, after all? Or could they have left out something? For hours, so the story goes, they struggled with the problem.

Finally, when they had all but given up hope of making the figures come within even a speaking agreement, and the room's single radiator had been measured forward and backward, the discovery was made of some capped connections intended for another radiator under another window.

Investigation disclosed that the office had formerly been occupied by the president of a large manufacturing corporation whose hobby was "fresh air." Finding the room frequently too warm to suit him, he ordered the removal of one of the offending radiators. It was therefore taken out and in the vicissitudes of various tenant changes, it was never restored.

Be that as it may, the discovery served to ward off an impending crisis of no mean magnitude, so that instead of scrapping the work of the association's Standardization Committee, the episode served only to increase the enthusiasm of headquarters for the "Standard Radiation Tables."

District Steam Heating in Congested New York City

To a larger extent than is generally realized business buildings in New York City are being heated by district steam systems. The greater bulk of buildings in the district bounded on the North by Duane Streets, on the west by the North River, the east by the Bowery and extending south as far as Bowling Green, are heated by steam generated in two central stations and distributed through underground steam mains.

The other district served with central steam stations comprises the important commercial and residential section extending from 36th street to 79th street, which also includes many large buildings.

The territory which the New York Steam Corporation, the largest concern of its kind, supplies presents an interesting field. The section is congested and difficulty is experienced in delivering coal and removing ashes. For this same reason private heating systems cannot always afford to store their fuel and operate their furnaces in view of the high value of the property. The corporation operating on a large scale buys fuel in large quantities and employs efficient heating systems on a scale impossible to the small plant.

The advantages of district steam heating in a city like New York is indicated by the fact that during the present fiscal year more than twenty-five buildings in the metropolis have

been or are being erected without boilers and in some cases without stacks. They have contracted or made commitments for district steam heating.

The New York Steam Corporation owns four steam stations, two in each of the territories served. The aggregate maximum capacity of the boilers is over 70,000 H. P. and economizers soon to be installed will increase this figure 10,000 H. P.

The equipment of the principal uptown station was installed within the past three years. The distribution system consists of 155,000 feet of mains and services and with mains in course of construction the total system will be 170,000 feet in length. About 90% of the mains have welded steel flanges, special expansion joints, asbestos and mineral wool insulation and are enclosed in conduits of concrete, brick and hollow-tile construction.

In anticipation of the future necessity of another steam generating station in the uptown district, the corporation has acquired through a subsidiary a site on the waterfront south of the Waterside Stations of The New York Edison Company, occupying about two-thirds of the block from 35th Street to 36th Street and from First Avenue to the East River.

WEBSTER SERVICE DETAILS, comprising 13 revised data sheets of the 157 sheet in the complete set, have recently been received from Warren Webster & Co., Camden, N. J. These sheets are designed to supply the contractor with accurate installation details of Webster systems. The sheets are cut and punched for loose-leaf binding. Methods of piping traps and radiators, schedules and specifications of traps, separators and strainers and schedules of tappings make up the revised service details received. The complete series is available to those who are interested in installation systems.

National problems of accident prevention were given attention at the 72 sessions of the Thirteenth Annual Safety Congress of the National Safety Council, in Louisville, Ky., September 29-October 3. Approximately 3000 were in attendance. Carl B. Auel, of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was elected president of the National Safety Council. Among the resolutions adopted was one pledging the assistance of the council to public officials and public agencies now engaged in public safety work. The organization of community safety councils was advocated wherever practicable in every sizable city and town, along lines similar to the 60 community safety councils now operating in the larger cities, the purpose of which is to create community interest in and accomplishment of increased safety in the home, on the street and in the industries.

Anthracite Coal Operators Announce New Device for Burning Buckwheat in House-Heating Boilers

IN THE HEATING AND VENTILATING MAGAZINE for September, under the title of "Why Buckwheat Bucks," reference was made to the important tests which were being made by the Anthracite Coal Operators with a view to developing an appliance which could be used in the ordinary house-heating boiler for burning buckwheat coal. It was recognized that some types of boilers, such as the magazine-feed, are now adapted to burning small-sized hard coals. The ordinary house-heating boiler, however, remained a problem.

After a long series of tests, the Anthracite Coal Operators have just announced that a group of engineers working under their direction have perfected a device for attachment to the average home heater to burn buckwheat economically. This new appliance, it is claimed, is capable of cutting the coal bill in half, as buckwheat sells at about half the price of the larger sizes.

The new device is called Inducto, a coined name, to emphasize the important principle of its operation, by induced draft. As Inducto is the first appliance to supply induced draft to an ordinary house heater, it is being studied carefully by engineers, architects and heating engineers.

Inducto is described as unique in construction. It comprises but three parts, a special grate for burning buckwheat, a blower to induce draft and an automatic control. The grate is fitted with a cleverly-concealed locking device which is used to limit the stroke of the shaking lever in order to prevent loss of coal.

The blower consists of a Sirocco fan directly connected to a ⅛H.P. motor. It is described as noiseless. Under normal conditions, the blower need be operated only an hour or so in the morning and at night. As the temperature reaches that desired, a balanced damper is designed to close automatically the exhaust from the blower, permitting the coal to burn under natural draft. Conversely, when

Inducto Induced Draft Appliance for Burning Buckwheat Coal in House-Heating Boilers

the temperature drops below that desired, the blower is started automatically. Recent tests have shown that the cost of current to operate Inducto is less than three cents a day.

The development and marketing of Inducto is part of a broad campaign of public education being conducted by the Anthracite Coal Operators to visualize the most economical method of using anthracite coal, and particularly the small cheap sizes. The program comprises the maintenance of five permanent service stations where home-owners may go for helpful information on the proper way to heat their homes. These bureaus are known as Anthracite Economy Services, and are located, as already mentioned in these columns, in New York, Brooklyn, Philadelphia, Boston and Washington. Heating experts are in charge. There is also an interesting exhibit in each city of approved heaters, boilers and grates for burning buckwheat, as well as the new device, Inducto.

In addition to the permanent "Services," the operators have put a traveling "Anthracite Economy Service Exhibit" on the road. It started at Portland, Me., the first week in September and will be shown a week in each of twenty cities in the East. Its purpose is educational.

The average home-owner has long been used to the large sizes of coal. The construction of his furnace and his general experience have brought this about. The result has been a demand almost entirely for the larger sizes, while the smaller sizes, such as buckwheat, have been sold only to large industrial plants and office buildings where automatic stokers are in use.

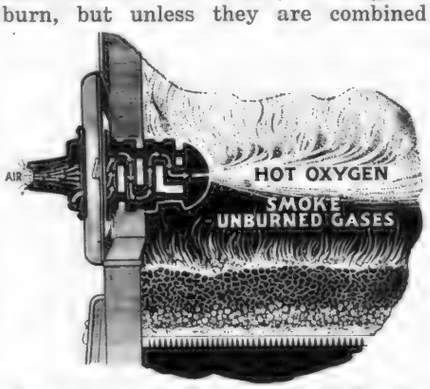
Many people do not know that buckwheat is the same coal as the larger sizes of anthracite, that it sells at about half the price and that it may be used entirely in the average home-heater. Therefore, if the consumer can be taught to order the smaller, instead of the larger, sizes, he will automatically bring about that thing for which he has been making such urgent demands, a reduction in the size of his coal bills. That is one of the things the operators hope to get over at the permanent service stations and through their traveling exhibit.

Overcoming Fuel Waste by Admitting Air Through Fire Doors

The appalling waste of fuel in the average heating plant is an undisputed fact. The clouds of smoke that hover the land and the tons of soot that defile the air, corroding metal surfaces, breeding disease and poisoning plant life, mock the boastfulness of a self-styled age of efficiency. Every day, all over the land, trainloads of fuel, Nature's most priceless gift to man, pour out of the throats of countless chimneys and are lost for all time. A care-free generation digs deeper and deeper into the available supply of fuel—abundant at present, yet limited in quantity—without thought for the generations which are to come.

It took a million years for Nature to lay down in the coal seams the fuel that the United States consumes in a year or two. Any method by which even a portion of this shocking waste can be prevented should appeal to every intelligent man.

There are two main causes of this waste. The first is imperfect combustion. Coal may be thoroughly consumed and yet give off little or no heat. A bed of live coals beneath a layer of fresh coal drives the gases out of the latter and leaves nothing but ashes and clinkers. Given air, these gases burn, but unless they are combined



Operation of Crown Fuel Saving Device

with oxygen they are wasted and no heat is evolved. Likewise, a hot fire, blanketed with a heavy overlying layer of fresh coal, means waste because it cannot communicate its heat to the heating chamber.

All heating and government experts say that a supply of air (oxygen) flowing up through a fuel bed does not insure perfect combustion—that half the air should pass through the fuel bed and the other half be supplied over the fuel bed. Without a full supply of free oxygen to combine with the free carbon gases there can be no combustion and without combustion there can be no heat.

Most heating plants send more unconsumed carbon up the chimney in the form of gas and smoke than they actually burn. It is impossible to pass free oxygen up through a bed of live coals thicker than 3½ to 4 in. into the heating chamber above because the free oxygen is consumed in passing through the incandescent bed.

Among a number of attempts to meet this serious problem the use of a so-called fuel-saver and smoke-consumer applied to the fire-door of the furnace has been tried with interesting results. In one type, shown in the accompanying illustration, the natural draft from the flue draws through the device a supply of air from the furnace room. This air in passing through the device is superheated and is then made to flow in a fan-like stream over the surface of the fire. In this way, state the manufacturers, it furnishes the necessary oxygen over the fuel bed which mixes in the heating chamber with the unconsumed carbon gases.

When this mixing is accomplished, these gases, instead of rolling up the chimney and being lost, are converted into a glowing flame, resulting in a second fire, with more intense heat, above the usual fire of coals.

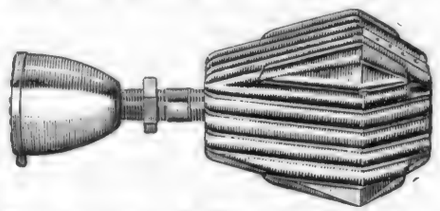
In addition to supplying the necessary oxygen over the surface of the fire, as government authorities urge, the device serves to superheat the oxygen to the combustion point. This causes the burning of the otherwise wasted gases and consumes much of the objectionable smoke. Another point advanced by the manufacturers is that it makes the hottest part of the fire on the upper surface where it does the most good, instead of underneath. In this way, of course, it is possible to save a large amount of fuel, reduce the amount of ashes and secure a more perfect and even heat, enabling heating plants which are grossly below the necessary requirements to give satisfactory service.

With the device described the manufacturers guarantee a saving of 20%. It is designed for use on domestic furnaces, apartment house boilers and in power plants. Recent improvements are announced in this device, one of them being a detachable nozzle so that in case of damage to the nozzle, under extreme heat conditions, it can be replaced. The system of baffling the air as it passes through the device also has been improved, provision now being made for preheating to a higher degree.

Burnrite Combustion Device

Burnrite Combustion Device, designed to be applied to the firing door of a house heating warm-air heater or boiler, is an interesting device which has recently been placed on the market by the John Simmons Co., New York. The device is the invention of P. J. Sovereign, a well-known heating man who was long connected with the contracting business in New York City.

Incomplete combustion, it is pointed out, is due mainly to two causes: in-



Construction of Burnrite Combustion Device

sufficient air supply and lack of mixing air with the combustible gases rising over the fuel bed. Completeness of combustion, it is maintained, is determined by the amount of preheated air admitted at this point.

The Burnrite device is designed to discharge the air in the form of a spray at the proper temperatures and quantities demanded by the natural draft of the equipment on which it is installed.

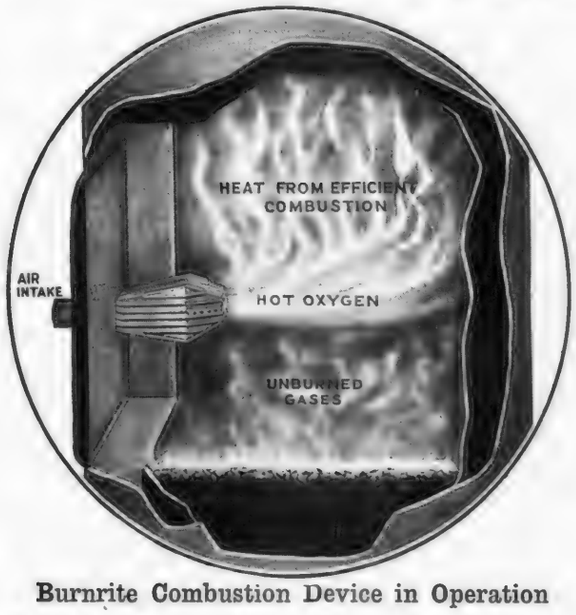
The device is said to be especially effective in eliminating coal gas, which just now has been brought prominently

to public notice through two accidents, each resulting fatally, caused by leaking carbon monoxide or coal gas. These fatalities, state the manufacturers, could have been avoided by the installation of Burnrite devices, as its use provides for the admission of the necessary oxygen over the fuel bed to mix with the carbon monoxide and ignite it.

Burnrite is described by the manufacturer as a secondary air device, giving secondary combustion to the gases distilled from the fuel bed. In this way the potential heat contained in the primary combustion, instead of passing up the chimney, may be converted into useful service.

Burnrite devices, it is stated, may be installed without any alterations or shutting down of the equipment. For a 30-in. round grate or an 18-in. x 32-in. square grate, one device is recommended. For a 32-in. round grate and larger and for a 36 x 54 in. square grate, two devices are used. The foregoing applies to equipment with one firing door. The savings possible in the amounts of coal burned with the Burnrite are placed at a minimum of 10% on high-pressure steam boilers, 15% on low-pressure steam boilers, 25% on water boilers and 25% on warm-air furnaces. In many cases these figures, it is stated, have been greatly exceeded.

An interesting demonstration of the Burnrite device is being given at the offices of the John Simmons Co., 110 Center Street, New York. The device is being distributed in the Boston district by the New England Air Conditioning Co., 53 Devonshire St., Boston, J. W. H. Myrick, engineer.



Burnrite Combustion Device in Operation

Construction of Meter Radiator Bushing

An idea of the present construction of the Metering Radiator Bushing, manufactured by the Holley Engineering Co., Virginia, Minn., is given in the accompanying illustrations. This device which has already been described in these columns, depends for its operation upon a carefully-designed aperture which is intended both to meter the amount of steam entering the radiator and to determine the direction in which it flows. By providing the radiators in the system with the proper apertures, it is maintained, as provided in these bushings, the correct amount of steam will be supplied to each of the radiators, and a change in the pressure on the entire system is all that is needed to suit changing weather conditions.

Metering Radiator Bushing, Showing its Construction and Application

The additional point is made that with a fixed aperture placed at the steam entrance to the radiator, no outside condition, such as exposure to cold wind, will affect the amount of steam passing into the radiator. This has a particular appeal to owners or operators of buildings where the rooms are rented heated. The opening of windows, therefore, will not increase the steam consumption, and it becomes an easy matter to reduce the temperature of the entire building during unoccupied hours.

In the present construction of the Metering Radiator Bushing, instead of machining the aperture in the casting of the bushing, a steam metal plug is now provided in which the aperture is machined. These plugs are made of varying lengths to meet the exact needs of the radiators. The characteristics of the varying lengths are a part of the method used for determining the correct aperture for each installation. The removable aperture plug also permits easy change, by a mechanic, of the steam supplied each radiator, should a change of building or room occupancy at any time require a change in distribution.

An unusual application of electric immersion heaters is being made by the Haserot Co., wholesale grocers of Cleveland, O. This company will install several General Electric heaters with an aggregate rating of 18 K.W. to prevent an 18,000-gal. sprinkler system from freezing during the winter months.

Test of a Gas-Fired Heating Boiler

Some notable results are reported in a test by the Consolidated Gas Light Co., of Baltimore of a Universal Tubular gas boiler, of the type manufactured by the Universal Smokeless Boiler Co., Ravenna, O. The test was conducted in the gas light company's testing laboratory at its Front Street Station and was made to determine the efficiency of the boiler for generating hot water and to learn the general characteristics of the boiler.

The boiler tested is of the gas-fired, water-tube type and is listed at 900 sq. ft. capacity. It has six sections of cast-iron, joined by 3-in push nipples. The front and back are the headers of the tubes. The sections are held together by four through bolts. The boiler as set up weighed 995 lbs. The dimensions were 25 in. overall width, 33 in. overall breadth and 44 in. overall height.

In this boiler the sides, top and front are of cast- iron. The sides are in one piece 39 in. high and serve as the support for the sections. The front is in three pieces, two of which are hinged together, forming a drop door for lighting the burner. The front, top and back castings are bolted to the side castings.

The boiler is equipped with six cast-iron, centrally-supplied burners having raised, drilled ports. There are two lead holes in each burner at an angle of 45 degrees for carying the flames to the adjoining burners. Adjustable air shutters are included.

All crevices in the boiler were closed with asbestos cement and a draft

breaker was installed in the flue line. The burners were adjusted to burn as much gas as it was possible to give them with the type of orifice supplied.

In running the test, the boiler was filled with water and the burners were lighted. The valve controlling the outlet of the boiler was adjusted so as to obtain a flow of hot water and maintain a constant temperature rise of the outflowing water. The water was then deflected into a pan placed on a pair of scales and readings of the temperatures of inlet water, outlet water and flue, as well as the gas meter reading, were taken at one-minute intervals until 300 lbs. of water had been heated. A flue analysis was then made after which several check tests were run, each time a different operator recording the readings. Such secondary data as room temperatures, barometer readings, B.T.U., gravity, gas pressure, etc., were noted and recorded.

Following are the results of calculations based on the data obtained in the test:

	Boiler Uncovered
Efficiency (heat imparted to water,) per cent.....	75.04
Heat lost up flue as sensible heat, per cent.....	6.20
Heat lost up flue as latent heat of water vapor, per cent.....	6.68
Heat lost by radiation, per cent.....	10.08
Gas consumption of burners, cu. ft. per hour.....	210.0
Air required for combustion of 1 cu. ft. of fuel gas (corrected) cu. ft..	4.45
Air supplied to boiler per cu. ft. of fuel gas (corrected) cu. ft.....	8.37
Excess air supplied per cu. ft. of fuel gas (corrected).....	3.92

RESULTS OF RUNNING WATER TEST
(Boiler not covered)

Time Min.	Time Sec.	Meter Cu. Ft.	Temp. Inlet Deg. F.	Temp. Outlet Deg. F.	Temp. Flue Deg. F.	Weight of Water Heated, Pounds
0		00.00	57	144	219	26
1			57	144	219	
2			57	144	218	
3			57	144	218	
4			57	144	218	
5			57	144	217	
6			57	144	218	
7			57	144	218	
8			57	144	219	
9			57	144	219	
10			57	144	220	
11			57	144	219	
12			57	144	220	
13			57	144	221	
14			57	143	220	
15			57	144	220	
16			57	144	220	
17	54	60.20	57	144	220	326
		60.20	57	143.95	219.1	300

Temperature of gas, 74 F.
Temperature of room, 76° F.
Barometer, 30.12 in.
Gravity, 0.533.
Pressure, inlet meter, 3.2 in.
Pressure, outlet meter, 3.1 in.
Factor for gas vol., 0.9763.

Fuel gas analysis,

CO_2	2.8%
C_2H_4	5.2
O_2	0.1
CO	21.8
CH_4	22.4
H_2	42.1
N_2	5.6
	100.0%

Flue gas analysis,

CO_2	6.4
O_2	10.6
CO	....
N_2	83.0
	100.0

Universal Tubular Gas Boiler Used in Test

New Books

ENGINEERING IN AMERICAN INDUSTRY, devoted to the development of industry in the United States during the past 120 years, is the subject of a notable volume by Conrad Newton Lauer, general manager of Day & Zimmerman, Inc., engineers. The text of the book comprises a lecture delivered by Mr. Laurer at Princeton University under the Cyrus Fogg Brackett Lectureship in Applied Engineering Technology. Many old prints are reproduced showing the state of the engineering art as applied to locomotives, water supply and steam engines. Following these is a large group of curves and charts which tell in graphical form the growth of engineering and industrial activities throughout the past century. In the light of modern telephone development the views reproduced of a telephone exchange of 1879 are of peculiar interest. A view of a Bessemer steel plant and of a gas works as they existed in 1884 are also shown, together with a cable car of 1876 and a trolley car of 1880. Size 9½ x 12 in. Pp. 94. Published by McGraw-Hill Book Co. Inc., New York. Price $2.50.

APPLICATION OF GAS TO HOUSE HEATING is the title of a reference book which has been published under the direction of the Industrial Gas Section of the American Gas Association. In addition to data on heat losses through building materials, the book gives authoritative information on the installation of steam, water and air heating systems using gas as a fuel. Gas-fired steam radiators are discussed, as well as free-flame and radiant type room heaters and garage heaters.

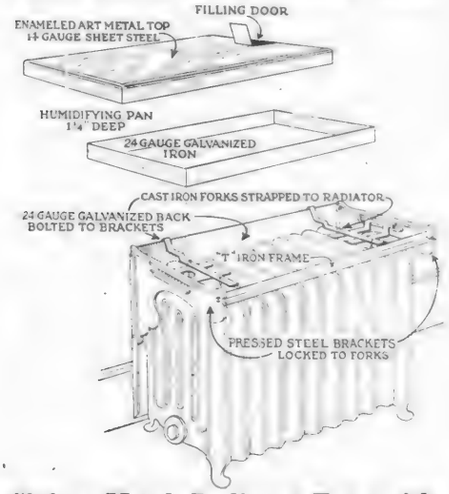
INSTITUTE OF RESEARCH OF LEHIGH UNIVERSITY is the title of a booklet recently published by that school. The work introduces the new institute, organized by the Board of Trustees on April 25, 1924. The board of directors of the new organization is composed of thirteen members, each a recognized authority in his special field. The object of the institute, as stated by E. G. Grace, president of the Bethlehem Steel Corporation and also president of the Lehigh Board of Trustees, is "to encourage and promote scientific research and scholarly achievement in every division of learning represented in the organization of the university."

New Ideas in the House Humidifying Field

Slyker Metal Radiator Furniture

In line with the tendency towards greater luxury in the equipment of homes and other buildings, the Slyker metal radiator furniture has been brought out to meet a corresponding demand for neater-looking and even handsome heating appliances. A variety of designs of radiator covers have been developed for use in such buildings as country clubs, fraternal buildings, hospitals, hotels, banks and office buildings.

One of the features of these units is a water pan extending the entire length


FILLING DOOR
ENAMELED ART METAL TOP 14 GAUGE SHEET STEEL
HUMIDIFYING PAN 1¼" DEEP
24 GAUGE GALVANIZED IRON
CAST IRON FORKS STRAPPED TO RADIATOR
24 GAUGE GALVANIZED BACK BOLTED TO BRACKETS
"T" IRON FRAME
PRESSED STEEL BRACKETS LOCKED TO FORKS

Slyker Metal Radiator Top, with Humidifying Pan

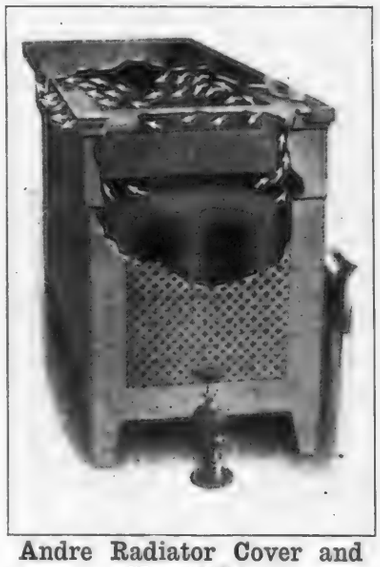
and width of the radiator and built so that the heated air, as it rises, will pass over the water and be deflected out and into the room. The accompanying illustration shows this feature. It will be noted that the humidifying pan is 1¼ in. deep so that it is capable of holding a sufficient amount of moisture for the entire day.

Slyker radiator furniture is made of heavy-guage steel, with corners and doors electrically welded. It is furnished in patterns of panel effects, in grilles of cane and square rod designs and in plain types. It is manufactured by Schleicher, Inc., 218 South Wabash Ave., Chicago.

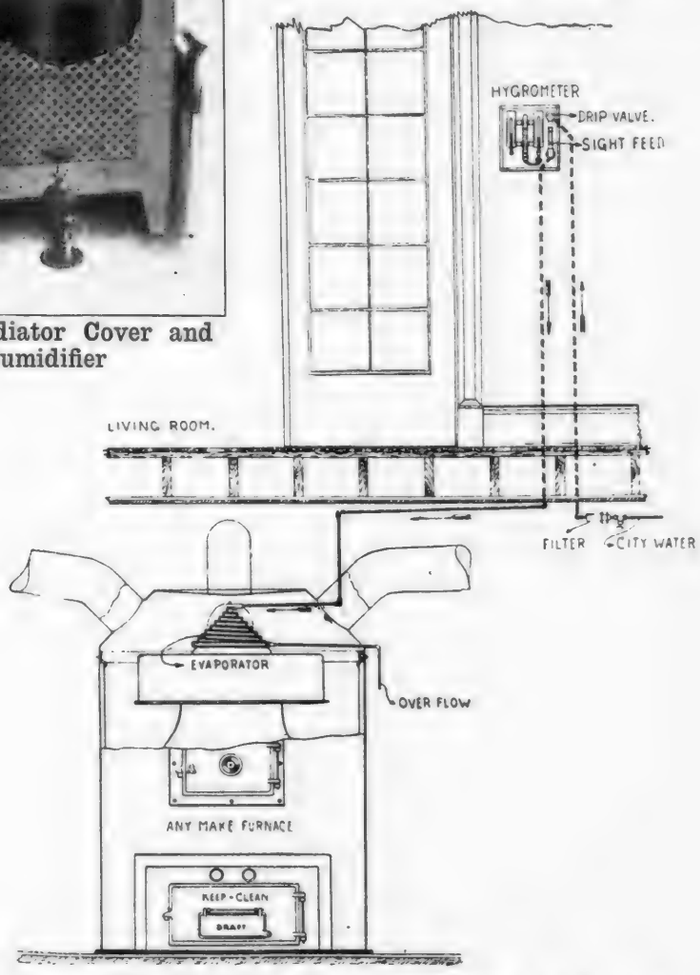
A Combined Radiator Cover and Humidifier

In line with the tendency towards concealing direct radiators in buildings, a radiator cover which, at the same time, is designed to arrange to supply moisture to the air, has been placed on the market by Andre & White, 63rd Street and Hoyne Ave., Chicago, Ill. It is called the Andre radiator rectifier. Unusual taste has been shown in the design of this cover which is made in several shapes to fit high and low radiators.

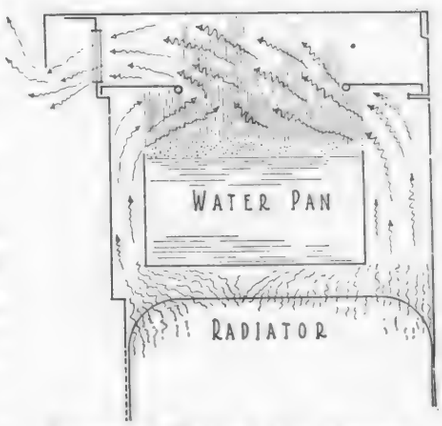
An idea of its construction may be had from the accompanying illustration. As will be seen, the cover contains a metal baffle plate to direct the warm air currents away from the wall. The water pan with which it is equipped is 2 in. deep and covers the entire top of the radiator. A large opening is provided for filling as required. The cover is made of furniture steel in various baked finishes, such as oak, walnut, mahogany, white, ivory, gray, etc. Due to the invisible openings above the radiator at the front and sides of the cabinet, the top lends itself to use as a table or window seat.



Andre Radiator Cover and Humidifier



Humidair as Applied to Warm-Air Furnace



Course of Heated Air Around Andre Radiator Rectifier

HUMIDAIR is the subject of a folder recently published by J. Roemer Heating Co., Cleveland, O. Humidair, a humidifying device for warm-air furnaces, is designed for use in both old and new installations. The signal feature is a cone-shaped unit over which water flows and evaporates. A hygrometer for humidity control is installed in the rooms above. The manufacturers recommend the Humidair to be particularly advantageous for maintaining the proper humidity, disinfecting the home or office and medicating the home to prevent illness.

(*Heating and Ventilating Magazine, November, 1924.*)

How To Heat Your Home

(The second of a series of articles giving practical information of fuels and furnaces.)

II Putting The Heat Where Needed

By Samuel S. Wyer

Associate in Mineral Technology, U. S. Smithsonian Institution.
(*Science Service.*)

KEEPING the house temperature lower is the easiest way to save fuel. It is fuel saved by doing less work.

Most houses are kept too warm. About 25% of the house fuel is used in raising the room temperature from 60° to 70° F. Houses can be kept five to ten degrees lower than is customary, —that is, kept at 62° to 68°,—without any discomfort or any danger to health.

In most houses, especially when warm-air furnaces are used, the room air is too dry for health and comfort. That is the "moisture-content" or humidity is too low. With proper humidity of air, not less than 30% lower temperatures may be comfortably maintained and less fuel used.

The humidifying equipment usually available is grossly inadequate. For instance, it would require the evaporation of ½ gal. of water an hour to maintain 40% relative humidity, with the room temperature at 70° F. and the outdoor temperature zero if 9,000 cu. ft. of air per hour, the proper amount for an average one family house, are used.

Most warm-air furnaces take their cold air only from the outside. This is wrong. When the basement is clean, by merely taking the air out of the basement, at least in severe and windy weather, a saving of 20% to 30% in the fuel required to heat the house can be made and the house kept more comfortable.

There is nothing novel in this. Warm-air furnaces have been installed on this plan for many years, the only surprising feature is that all furnaces are not installed in this way, instead of an occasional one.

The carbon dioxide content in the air of the living room should be kept below 7 parts in 10,000 by ventilation. Each person exhales about 6/10 cu. ft. of carbon dioxide per hour and about 1,800 cu. ft. of fresh air is necessary for each person per hour to dilute the carbon dioxide.

One complete change of air an hour in an occupied room of a home is adequate and the outdoor air leaking in through cracks in floors, walls around windows and doors and through porous walls is not objectionable. However, during high winds there may be as many as five changes of room air each hour. This not only wastes fuel but may make adequate heating impossible.

Prevention of unnecessary cold air leakage into the house not only saves heat, and, therefore, fuel, but decreases the dirt blown in. In cold climates, on the side of the prevailing winds, storm sashes are effective. Calking material around window and door frames and weather-stripping for doors and windows, when properly put on, are a good means of reducing unnecessary cold air leakage. In many houses the space between the roof and the upper story is so open as to let cold air get in or heat radiate out through the ceiling. Cellars are always desirable since floors where the wind can get underneath are not only uncomfortable but serious heat wasters. In many of the recent houses, especially those "built to sell" the construction is so defective that a reasonably tight room cannot be secured. Fuel savings of 15% to 25% are easily possible by making the house tight.

Respiratory diseases cause about one-third of all the deaths in this country. Practically all other forms of bacterially-caused diseases have been brought under control in the last fifty years, while respiratory diseases have increased. Pneumonia is one-third more frequent in urban than in rural districts. The seasonal cycle of pneumonia, where house heating is necessary, is startling. The highest death rate occurs during the heating seasons. This is believed to be due to lowering of vitality on account of improper heating and ventilation. The toxic action from combustion products, especially carbon monoxide, from flueless gas heating stoves is undoubtedly also important.

Most warm-air furnaces have a sluggish warm-air draft, depending on the wind, on some days or to some rooms of the house. Placing an electric motor fan in the cold-air intake will make the draft positive and independent of atmospheric conditions. A fan will increase the volume of air going through the furnace and deliver more heat but at lower register temperature, that is, deliver "warm" instead of "hot" air. This will result in better living conditions in the room; and the utilization of more heat from the fuel, thus decreasing the fuel consumption.

(*Next Month: How to Use Anthracite.*)

New Publications

A CHAPTER IN AMERICAN EDUCATION is the title of a book writen by Ray Palmer Baker for Rensselaer Polytechnic Institute in commemoration of its hundredth anniversary. The first two chapters of the work deal with the early history of technical education. Rensselaer is the oldest engineering institution and though it no longer carries agriculture in its curriculum it has the added distinction of being the pioneer in that field as well. Stephen Van Rensselaer, the wealthy patroon of Rensselaer-wick and founder of the school, was aided in his work by Amos Eaton, a graduate of Williams College. Mr. Baker is head of the English department of the institution at the present time. The book is published by Charles Scribner Sons, New York, Pp. 170.

BRITISH ENGINEERS' ASSOCIATION DIRECTORY OF MEMBERS AND THEIR MANUFACTURES, 1924, has been issued by the British Engineers' Association. It contains the names and address and other information regarding British manufacturing engineers and includes practically every known manufacture. This association is the recognized and representative trade organization of the British engineering industry and acts, among other ways, as a means of furnishing foreign buyers with a full range of quotations and particulars without charge or obligation. Copies of the directory are available gratis by addressing the secretary of British Engineers' Association, 32, Victoria St., London, S. W. 1.

ELECTRIC HEATING is the subject of an article in the annual report of the Department of Lighting, City of Seattle, Wash. In 1912 the department made a number of tests on the efficiency of domestic warm-air furnaces and came to the conclusion that they averaged about 40% efficient. Current at a 1 cent rate is equivalent to coal at $20.00 a ton, assuming a furnace efficiency of 40%. Since this efficiency is somewhat smaller for small residences, a 1 cent rate may be equivalent to $15.00-coal.

To calculate the capacity of heaters required based on a 60° F. difference in temperature between outside and inside the home:

For B.T.U. per hour, add	
Sq. ft. area of windows and sash multiplied by	66
Sq. ft. area of walls multiplied by	20
Sq. ft. area of ceiling multiplied by	10
Sq. ft. area of floors (unheated basement) multiplied by	12
Cu. ft. of air changed per hour multiplied by	0.8

This sum divided by 3,412 equals the kilowatt capacity of heaters required.

The City of Seattle recommends electric heating; provided sufficient power

can be supplied to meet the increasing demands. However, should a great increase in the power supply be made possible electric heating would care for the surplus current until an influx of new industries made its demands.

A 1 cent rate, now given by the city as its third rate for domestic purposes, makes electric heating a much easier problem than in many cities where power is not to be had at such a low cost.

TRANSACTIONS OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS FOR 1922 (Vol. 28) has been issued, covering the proceedings at the society's annual meeting in New York, in January, 1922, and the semi-annual meeting in Buffalo-Detroit, in June of that year. In addition to the papers and the stenographer's notes of the discussions, numerous written discussions are included, notably one by J. M. Robb on ozone in school ventilation, another by E. H. Lockwood on home heating, and one by the late William J. Baldwin on humidity needs in furnace-heated houses. It is interesting to note also the revised discussion of this subject by Dr. Wolff Freudenthal and F. R. Still. Mr. Baldwin had stated that in humidifying a house the extra cost of the fuel was great enough to be taken into consideration when the question of humidifying the air of a residence in winter was considered. To illustrate his point, Mr. Baldwin cited a 12-room house burning a ton of coal per room per winter. This means an average New York winter of from 182 to 200 days. Therefore, he continued, it is reasonable to assume a 12-room brick house in a New York City block requires an average of 12 tons of anthracite coal for a winter of 200 days (no humidifying). Twelve tons of dry coal weigh 24,000 lbs. and this calls for 120 lbs. of coal per day, or 5 lbs. of coal per hour, through day and night, representing 50,000 B.T.U. available hourly.

If each of the rooms of the house averages 1,000 cu. ft. of air space, and we change the air only twice an hour, then we have to humidify 24,000 cu. ft. of air per hour for the house if we desire to keep it at some reasonable standard of humidity, say 50% to 60% of saturation. Air at 70° F. when saturated, holds very nearly 8 grains of moisture per cubic foot, and 50% of saturation, will be over 4 grains, while the air outside in winter weather, contains only between 1 and 2 grains of moisture. Thus the air may be considered practically dry, when admitted to the house (say 1 grain to the cubic foot). Therefore, it is not unreasonable to assume that we must add 4 grains and over of moisture, to each cubic foot of air entering the house in an hour, if we are going to keep the air in the house at anything near 50% of saturation.

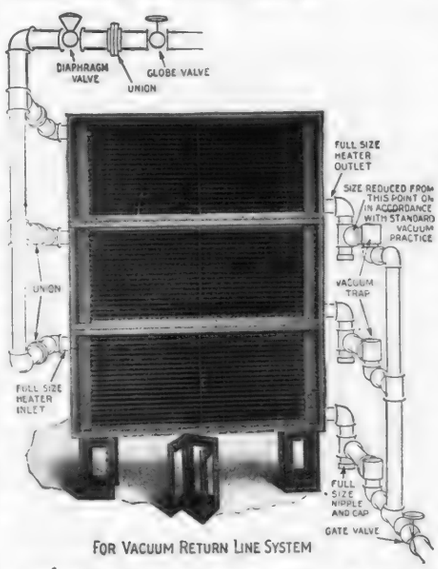
This means that we have to evaporate 96,000 grains of water in an hour, or very nearly 2 gals. of water per hour, for the house and conditions assumed; or more accurately 14 lbs. of water, the equivalent of about 14,000 B.T.U. Therefore the quantity of fuel for heat alone per hour is 50,000 B.T.U. and for humidifying, 14,000 B.T.U. per hour, which is considerably over 25% of the amount of fuel required for heating alone (not considering the warming of the vapor of water to the house temperature).

Dr. Wolff Freudenthal in his discussion, said we need more humidity in our homes. We need humidity firstly for our own well-being and then for the preservation of our furniture, our books, our plants, etc. The minimum requirement should be 40% relative humidity. We need more humidity to be healthy. These days you see many people walking around with bronchitis and all sorts of affections in the throat and nose. They feel dull. As soon as they take a hot-water plunge, inhale warm water, they feel entirely different. You feel the same depression after you come out of the opera house, which is comparatively better ventilated, so far as I know, than other institutions of that class. The reason is that the atmosphere there is too dry.

F. R. Still contributed to the discussion by stating that it is a well-known fact that in a house where no attempt has been made to humidify the air, instead of carrying the temperature at about 70° F. it is more generally around 80° or 84°. If the relative humidity should be raised to about 50% at this latter temperature, we could not stand it. With a relative humidity of 45% to 50%, we would all be perfectly comfortable with a temperature of 64° to 66°, which will save just about as much coal as the lower temperature would amount to, less the cost to heat the water required to produce the desired humidity. In other words, approximately all the heat we put into the water goes into the house.

New Trade Publications

AEROFIN APPARATUS is the subject of an unusually attractive bulletin (second edition, 1924) received from the Aerofin Corporation, 750 Frelinghuysen Ave., Newark, N. J. Aerofin tubing is made of two metals; copper and brass. About a straight, seamless copper tube is wound a helix of thin, narrow brass ribbon, made metallically integral with the tube by means of a special solder bath. The brass ribbon is crimped or corrugated at the inner edge. The advantage of this bi-metallic construction lies in the fact that it is practically non-corrosive. An insert folder gives a partial list of up-to-date installations. American Tobacco Co., American Lithographic Co., Beech-Nut Packing Co., and Eastman Kodak Co. are among those listed as recent users.



Typical Installation of Aerofin, Showing Steel Supporting Legs

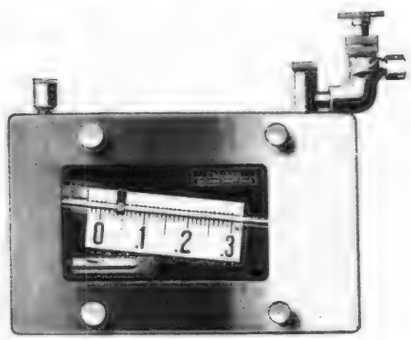
G-R SECTIONAL CONDENSER, for condensing hydrocarbon vapors and other vapors, is illustrated and described in a circular (Form 198) issued by the Griscom-Russell Co., 90 West St., New York. This apparatus, it is stated, which is built in two or more sections, will operate either as a standard, reflux or partial condenser and can also be used as a condenser and heat exchanger at the same time. For standard operation the vapor enters the upper shell and passes down through the successive sections over the banks of tubes through which water, oil or other circulating liquid is flowing. Besides flexibility of arrangement flexibility of capacity may be obtained by using as many sections as desired.

RED HEAD STEAM TRAPS are illustrated and discussed in a comprehensive circular of the Ellis Drier Co., 1201-1223 So. Talman Ave., Chicago. The Ellis trap is designed for the purpose of removing condensation from high- and low-pressure steam lines and steam-heated apparatus. The trap is of the intermittent discharge type, so constructed to prevent wire-drawing of the valve. Illustrations of assemblies and unit parts are provided in the booklet together with tabulated price lists.

FRONT RANK SPIRIT, the monthly house organ of the Langenberg Manufacturing Co., 4519 Euclid Ave., St. Louis, Mo., contains much interesting information for the warm-air furnace dealers. The October issue, while aimed primarily at the company's own dealers, tends to provide favorable publicity for warm-air heating in general. A department on advertising, another on credit and a third on stock-carrying

prove very comprehensive and instructive.

ELLISON DRAFT GAGES are presented in Bulletin No. 5, a 16-page booklet, and Bulletin No. 6, an 8-page booklet, of Lewis M. Ellison, 214 W. Kinzie St., Chicago. The earlier publication deals with single- and double-scale draft



Ellison Draft Gage for Domestic Boilers and Furnaces

gages while the latter introduces the gage with three and four scale-readings. The design of the new models is identical with the older ones save for necessary mechanical changes to provide for the additional readings. Special types are available for conditions where draft values are below ½ in. In a smaller size is a gage for domestic boilers and furnaces. A more durable model is marketed for travelling engineers and another for technical institutions. Price lists are contained in the booklet.

100 AND 1 WAYS TO SAVE MONEY WITH PORTABLE AIR POWER, showing the variety of uses of portable air compressors, are given in a 72-page booklet issued by the Ingersoll-Rand Co., 11 Broadway, New York. One of the uses of interest to central station heating men is in trench digging where stiff clay or hard ground is encountered. Figures are given for a typical excavating job in connection with a trench 100 ft. long, 5 ft. deep and 2 ft. wide, comprising 1000 cu. ft. to be removed. While hand digging would bring the cost of the work to $70.00 or

Digging Trench with Portable Air Compressor

70 cents per 10 cu. ft., the use of air picks, it is stated, brings down the cost to $40.00, without adding the compressor charge of $12.00, making the total cost $52.00.

New Heating Ordinance for Chicago

On September 30, 1924, a revised ordinance which specify minimum heat in apartments, offices and factories went into effect in Chicago. For apartment buildings the minimum temperature is fixed at 60° F. at 6:30 A. M., 65° F. at 7:30 A. M., 68° F. at 8:30 A. M. and thereafter until 10:30 P. M. In factories, offices and other commercial buildings a temperature of 68° F. must be maintained between 8:00 A. M. and 6:00 P. M. Penalty in case of violation is fixed at not less than $25 nor more than $200.

Deaths

HENRY R. TOWNE, chairman of the board of directors and one of the founders of the Yale & Towne Mfg. Co., lock manufacturers, died October 15 at his home in New York. He was 80 years old. Mr. Towne was widely known as an engineer. He was a past president of the American Society of Mechanical Engineers and had also served as president of the Merchants' Association of New York for five years, from 1908 to 1913.

RUSSELL G. BROWN, who had been associated with John A. Serrell in the New York office of Warren Webster & Company since 1903, died September 25 at his home in East Orange, N. J. Mr. Brown was in his 38th year. He was a graduate of the Polytechnic Institute of Brooklyn with the degree of mechanical engineer. For several years he was an instructor in technical subjects at the Fawcett School and at the Polytechnic Institute. He was a member of the American Society of Mechanical Engineers.

MICHAEL E. HERBERT, president of the Herbert Boiler Co., Chicago, Ill., died at his home in Chicago, after a short illness. Mr. Herbert was the originator of the Herbert magazine steam and water boiler which he started to manufacture in 1879. In the intervening years he built up one of the largest boiler plants in the Middle West. Mr. Herbert was born in Ireland in 1851 and came to this country when 17 years of age. He originally entered the plumbing and gas-fitting trade. After getting a practical knowledge of these trades, he entered the plumbing contracting business with his brother, Charles J. Herbert, who is still in the plumbing business in Chicago.

In 1879 Mr. Herbert moved to St. Joseph, Mo., where he started to manufacture the Herbert boiler under the name of M. E. Herbert. In 1893 he moved to Chicago at which time the Herbert Boiler Company succeeded the firm of M. E. Herbert. During the past year the active management of the business has been handled by his sons, William H., Charles A. and Joseph I. Herbert, who will continue the manufacture of the Herbert line, including the Herbert patented boilers, garbage burners, heaters, etc.

WALTER JONES, founder and principal of Messrs. Jones & Attwood, Ltd., Stourbridge, England, and the second president of the Institution of Heating and Ventilating Engineers, died recently at the age of 78. He had retired from active business in 1922. Mr. Jones was the inventor of a number of improvements in water heating devices and was the author of "Heating by Hot Water," which is considered a standard work in England. He took an active part in the founding of the Institution of Heating and Ventilating Engineers of England and until recently was a regular attendant at its meetings.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912 OF THE HEATING AND VENTILATING MAGAZINE published monthly at Albany, N. Y., for October 1, 1924.

State of New York, County of New York, ss:

Before me, a notary public in and for the State aforesaid, personally appeared Arthur S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of said publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, Arthur S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor, None.

Business Manager, Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Arthur S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than of a bonifide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

ARTHUR S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 15th day of September, 1924

Reuben B. Smith,
Notary Public Kings County.
(My term expires March 30th, 1926.)

.:!:.

PARTIAL LIST OF USERS OF POWERS CONTROL

Sears Roebuck & Co.
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Eastman Kodak Co.
American Woolen Co.
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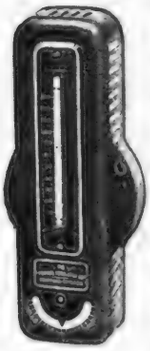
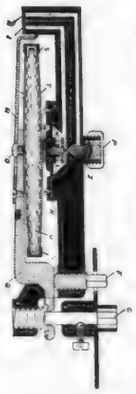
Chicago Telephone Co.

POWERS CONTROL IS LOWEST IN COST-PER-YEAR





Powers K Thermostat and cross section of operating mechanism

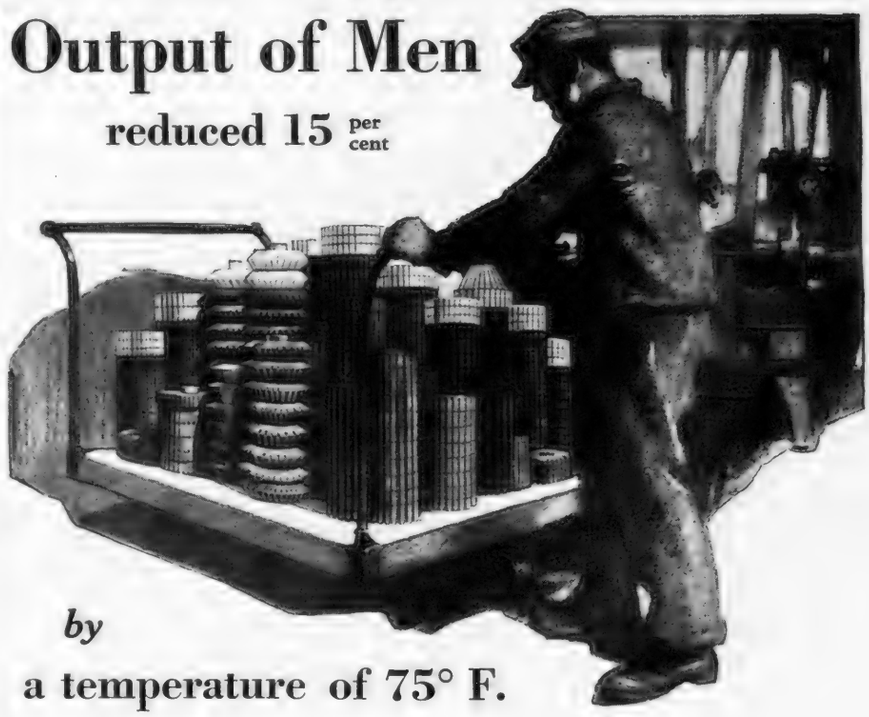
The brains of a system of temperature control are its Thermostats. Radiator Valves, Damper Motors, Air Compressors and Piping merely help to carry out the commands of Thermostats. These parts may be of good quality and carefully installed, yet if the Thermostats, which control and operate them, frequently get out of adjustment, earnings on the money invested in the apparatus are reduced by *waste of fuel* and *"service" bills.*

Powers VAPOR DISC Thermostats *need no annual adjustment.* Extremes of temperature in summer, and the occasional chill of unheated rooms in winter develop no error in their adjustment.

Write for this book

Our book "The Elimination of Heat Waste" shows why Powers Thermostats give such accurate and DEPENDABLE control, often without repairs of any kind for 10 to 15 years. May we send you a copy?

Output of Men reduced 15 per cent



by

a temperature of 75° F.

Says N. Y. State Commission on Ventilation

BY examining some of the evidence recently brought to light on the harmful effect which overheating has on the output of men, Heating and Ventilating Engineers may be able to save their clients many thousands of dollars.

In workshops, where employees are stirring around actively, it is generally agreed that the air should always be kept at a uniform temperature lower than 68° F.

Most Workrooms Are Overheated

The New York State Commission on Ventilation, in its thorough investigation carried on in industrial plants of New York State, found that in the work-rooms under observation, 71 per cent were at a temperature over 72° F. and 29 per cent were at a temperature over 79° F.

This is not surprising when you consider that heating systems are designed to heat buildings properly during severely cold weather. About 5 to 10 per cent of each heating season is "severely cold" so that during the remaining 90 per cent, overheating is common.

Effect of Overheating on Output of Men

On this subject, the N. Y. State Com. on Ventilation states in its report: "We have demonstrated a very marked and significant influence of atmospheric temperature upon the performance of physical work. *An increase of room temperature from 68° F. to 75° F. caused a decrease of 15 per cent in the physical work performed by men who were not compelled to maximum effort but were stimulated by a cash bonus.*"

The Commission also states that a rise in temperature to 86° F., under the same conditions, resulted in a decrease of 28 per cent in output.

Get this for your files

Other important facts which clearly show the necessity of providing adequate, ACCURATE and DEPENDABLE temperature control in workrooms will be found briefly stated in Vol. 5, No. 2, of our magazine, "The ThermostaT."

Upon request we shall be glad to send you a copy for your files, without cost or obligation.

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33 years of specialization in automatic temperature control

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

One-Column Steam, Rating with Shield

STEAM AT 215°F

1 COLUMN RADIATOR

RATING WITH SHIELD

SECTIONS	LENGTH IN INCHES	38" Actual Surface	38" Equivalent surface at 250 b.t.u. per sq. ft. H-6"	32" Actual Surface	32" Equivalent surface at 250 b.t.u. per sq. ft. H-5"	26" Actual Surface	26" Equivalent surface at 250 b.t.u. per sq. ft. H-4"	23" Actual Surface	23" Equivalent surface at 250 b.t.u. per sq. ft. H-4"	20" Actual Surface	20" Equivalent surface at 250 b.t.u. per sq. ft. H-4"
2	5	6	8.7	5	7.5	4	6.2	3⅓	5.5	3	5.0
3	7½	9	11.8	7½	10.2	6	8.4	5	7.4	4½	6.9
4	10	12	14.8	10	12.8	8	10.4	6⅔	9.4	6	8.6
5	12½	15	17.9	12½	15.5	10	12.8	8⅓	11.3	7½	10.5
6	15	18	21.1	15	18.3	12	14.9	10	13.2	9	12.2
7	17½	21	24.2	17½	21.0	14	17.1	11⅔	15.2	10½	14.2
8	20	24	27.4	20	23.8	16	19.5	13⅓	17.2	12	16.0
9	22½	27	30.6	22½	26.5	18	21.8	15	19.2	13½	18.0
10	25	30	33.8	25	29.3	20	24.0	16⅔	21.2	15	19.7
11	27½	33	36.8	27½	31.9	22	26.1	18⅓	23.2	16½	21.6
12	30	36	40.0	30	34.6	24	28.5	20	25.1	18	24.0
13	32½	39	43.2	32½	37.3	26	30.7	21⅔	27.2	19½	25.3
14	35	42	46.2	35	40.1	28	32.9	23⅓	29.1	21	27.2
15	37½	45	49.5	37½	42.9	30	35.2	25	31.1	22½	28.9
16	40	48	52.6	40	45.5	32	37.4	26⅔	33.1	24	30.8
17	42½	51	55.5	42½	48.1	34	39.6	28⅓	35.0	25½	33.0
18	45	54	58.6	45	50.8	36	41.9	30	37.0	27	35.3
19	47½	57	61.9	47½	53.7	38	44.7	31⅔	39.0	28½	36.3
20	50	60	64.9	50	56.3	40	46.4	33⅓	40.8	30	38.0
21	52½	63	67.9	52½	58.8	42	48.5	35	42.7	31½	39.9
22	55	66	71.1	55	61.7	44	51.3	36⅔	44.8	33	41.6
23	57½	69	74.0	57½	64.2	46	53.0	38⅓	46.6	34½	43.4
24	60	72	77.0	60	67.0	48	55.8	40	48.7	36	45.2
25	62½	75	81.2	62½	69.5	50	57.4	41⅔	50.5	37½	47.2
26	65	78	83.4	65	72.3	52	59.6	43⅓	52.2	39	49.0
27	67½	81	86.6	67½	75.1	54	62.5	45	54.5	40½	50.7
28	70	84	89.4	70	77.5	56	64.0	46⅔	56.4	42	52.6
29	72½	87	92.2	72½	79.7	58	66.0	48⅓	58.2	43½	54.4
30	75	90	95.4	75	82.8	60	68.2	50	60.2	45	56.0
31	77½	93	98.1	77½	85.2	62	70.3	51⅔	61.9	46½	57.6
32	80	96	101.3	80	88.0	64	72.6	53⅓	64.0	48	59.5
33	82½	99	104.1	82½	90.3	66	74.6	55	65.7	49½	61.2
34	85	102	107.2	85	93.1	68	76.9	56⅔	67.6	51	62.9
35	87½	105	109.9	87½	95.5	70	78.8	58⅓	69.4	52½	64.1
36	90	108	113.1	90	98.1	72	81.3	60	70.4	54	66.4
37	92½	111	115.7	92½	100.4	74	83.9	61⅔	73.1	55½	68.3
38	95	114	118.8	95	103.2	76	85.2	63⅓	75.0	57	69.8
39	97½	117	121.5	97½	105.6	78	87.1	65	76.8	58½	71.7
40	100	120	124.5	100	108.2	80	89.3	66⅔	78.8	60	73.6

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Radiator Ratings—1-Col. Steam, Rating with Shield | No. 14-P

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Two-Column Steam, Rating with Shield

STEAM AT 215°F

2 COLUMN RADIATOR

RATING WITH SHIELD

SECTIONS	LENGTH IN INCHES	45"		38"		32"		26"		23"		20"	
		Actual Surface	Equivalent surface at 250 btu. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 btu. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 btu. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 btu. per sq. ft. H=5"	Actual Surface	Equivalent surface at 250 btu. per sq. ft. H=4"	Actual Surface	Equivalent surface at 250 btu. per sq. ft. H=4"
2	5	10	12.1	8	10.4	6⅔	9.1	5⅓	7.4	4⅔	6.7	4	5.9
3	7½	15	16.6	12	14.0	10	12.4	8	10.1	7	9.0	6	8.1
4	10	20	20.9	16	17.7	13⅓	15.5	10⅔	13.2	9⅓	11.4	8	10.2
5	12½	25	25.1	20	21.6	16⅔	18.9	13⅓	15.8	11⅔	14.9	10	12.3
6	15	30	29.8	24	25.3	20	22.1	16	18.8	14	16.4	12	14.5
7	17½	35	34.3	28	29.1	23⅓	25.5	18⅔	21.6	16⅓	18.7	14	16.7
8	20	40	38.8	32	32.9	26⅔	28.9	21⅓	24.3	18⅔	21.2	16	18.9
9	22½	45	43.3	36	36.6	30	32.2	24	26.9	21	23.7	18	21.1
10	25	50	47.9	40	40.4	33⅓	35.5	26⅔	29.9	23⅓	26.0	20	23.3
11	27½	55	52.1	44	44.2	36⅔	38.8	29⅓	32.4	25⅔	28.5	22	25.4
12	30	60	56.6	48	48.0	40	41.9	32	35.0	28	30.9	24	27.7
13	32½	65	61.0	52	51.8	43⅓	45.2	34⅔	37.7	30⅓	33.3	26	29.7
14	35	70	65.5	56	55.4	46⅔	48.5	37⅓	40.2	32⅔	35.6	28	31.9
15	37½	75	69.8	60	59.0	50	51.8	40	43.2	35	38.0	30	34.1
16	40	80	74.2	64	62.8	53⅓	54.9	42⅔	45.9	37⅓	40.4	32	36.2
17	42½	85	78.4	68	66.5	56⅔	58.2	45⅓	48.5	39⅔	42.7	34	38.3
18	45	90	83.1	72	70.5	60	61.6	48	51.5	42	45.2	36	40.5
19	47½	95	87.1	76	74.2	63⅓	64.7	50⅔	53.9	44⅓	47.4	38	42.7
20	50	100	91.4	80	77.4	66⅔	67.8	53⅓	56.8	46⅔	49.9	40	44.7
21	52½	105	95.9	84	81.3	70	71.1	56	59.4	49	52.3	42	46.9
22	55	110	100.1	88	84.9	73⅓	74.4	58⅔	62.2	51⅓	54.8	44	48.9
23	57½	115	104.9	92	89.9	76⅔	77.8	61⅓	64.9	53⅔	57.0	46	51.1
24	60	120	108.9	96	92.2	80	80.8	64	66.6	56	59.3	48	53.2
25	62½	125	113.2	100	96.2	83⅓	84.1	66⅔	70.2	58⅓	61.6	50	55.4
26	65	130	117.3	104	99.6	86⅔	87.0	69⅓	73.2	60⅔	64.8	52	57.6
27	67½	135	121.7	108	103.2	90	90.4	72	75.4	63	66.6	54	59.6
28	70	140	125.6	112	106.4	93⅓	93.4	74⅔	78.5	65⅓	68.8	56	61.8
29	72½	145	130.1	116	110.6	96⅔	97.0	77⅓	80.9	67⅔	71.1	58	63.8
30	75	150	133.8	120	113.7	100	99.6	80	83.3	70	73.3	60	65.9
31	77½	155	137.9	124	117.0	103⅓	103.0	82⅔	85.4	72⅓	75.3	62	67.5
32	80	160	141.8	128	120.5	106⅔	105.8	85⅓	88.6	74⅔	77.7	64	69.6
33	82½	165	146.0	132	124.1	110	108.5	88	90.8	77	79.9	66	71.7
34	85	170	150.5	136	127.7	113⅓	112.0	90⅔	93.6	79⅓	82.2	68	73.9
35	87½	175	154.2	140	130.8	116⅔	114.8	93⅓	96.0	81⅔	84.3	70	75.8
36	90	180	158.9	144	134.7	120	118.1	96	98.6	84	86.7	72	77.9
37	92½	185	163.0	148	138.2	123⅓	121.3	98⅔	101.4	86⅓	89.2	74	80.1
38	95	190	166.6	152	141.4	126⅔	123.5	101⅓	104.0	88⅔	91.3	76	82.0
39	97½	195	171.2	156	145.3	130	127.3	104	106.4	91	93.6	78	84.0
40	100	200	175.5	160	149.2	133⅓	130.5	106⅔	109.3	93⅓	95.9	80	86.1

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Radiator Ratings—2-Col. Steam, Rating with Shield | No. 14-Q

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Three-Column Steam, Rating with Shield

STEAM AT 215°F

3 COLUMN RADIATOR

RATING WITH SHIELD

SECTIONS	LENGTH IN INCHES	45"		38"		32"		26"		22"		18"	
		Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft H=6"
2	5	12	13.3	10	11.6	9	11.1	7½	9.8	6	8.4	4½	6.6
3	7½	18	18.1	15	13.9	13½	15.1	11¼	13.3	9	11.3	6¾	9.0
4	10	24	22.8	20	20.0	18	18.6	15	16.7	12	14.2	9	11.8
5	12½	30	27.6	25	24.2	22½	22.8	18¾	20.3	15	17.3	11¼	14.1
6	15	36	32.4	30	28.8	27	26.8	22½	23.9	18	20.3	13½	16.9
7	17½	42	37.3	35	32.8	31½	30.9	26¼	27.3	21	23.5	15¾	19.2
8	20	48	42.2	40	37.6	36	35.0	30	31.3	24	26.4	18	21.8
9	22½	54	47.5	45	41.8	40½	39.4	33¾	34.5	27	29.7	20¼	24.1
10	25	60	52.2	50	45.9	45	43.2	37½	38.3	30	32.7	22½	26.6
11	27½	66	56.7	55	50.3	49½	47.1	41¼	41.6	33	35.5	24¾	29.0
12	30	72	61.9	60	54.5	54	51.4	45	45.4	36	38.7	27	31.6
13	32½	78	67.1	65	59.0	58½	55.0	48¾	48.7	39	41.0	29¼	34.0
14	35	84	72.2	70	63.6	63	59.3	52½	52.4	42	44.8	31½	36.7
15	37½	90	76.5	75	67.4	67½	63.5	56¼	56.1	45	47.9	33¾	39.0
16	40	96	81.6	80	71.9	72	68.8	60	60.0	48	50.6	36	41.6
17	42½	102	86.7	85	76.5	76½	72.0	63¾	63.6	51	53.8	38¼	44.2
18	45	108	90.7	90	80.8	81	75.2	67½	66.8	54	57.0	40½	46.6
19	47½	114	95.8	95	84.3	85½	79.6	71¼	70.5	57	60.2	42¾	48.9
20	50	120	100.8	100	88.8	90	83.8	75	74.1	60	63.4	45	51.7
21	52½	126	105.8	105	93.2	94½	87.0	78¾	77.0	63	65.8	47¼	54.0
22	55	132	110.8	110	97.6	99	91.2	82½	80.8	66	69.3	49½	56.6
23	57½	138	115.9	115	102.3	103½	95.3	86¼	84.3	69	72.5	51¾	59.1
24	60	144	119.6	120	105.3	108	99.9	90	88.0	72	75.2	54	61.5
25	62½	150	124.5	125	109.7	112½	103.8	93¾	91.7	75	78.3	56¼	63.0
26	65	156	129.4	130	114.2	117	107.8	97½	95.0	78	81.5	58½	66.7
27	67½	162	134.4	135	118.5	121½	110.7	101¼	97.9	81	83.7	60¾	68.8
28	70	168	137.7	140	122.9	126	114.2	105	101.5	84	86.8	63	71.1
29	72½	174	142.6	145	127.3	130½	119.0	108¾	105.1	87	89.8	65¼	73.6
30	75	180	147.6	150	130.2	135	123.0	112½	108.8	90	93.0	67½	75.8
31	77½	186	151.5	155	134.5	139½	127.2	116¼	112.3	93	96.1	69¾	78.0
32	80	192	157.4	160	138.8	144	131.3	120	116.1	96	99.2	72	80.8
33	82½	198	162.3	165	143.2	148½	133.8	123¾	119.7	99	101.2	74¼	83.1
34	85	204	162.2	170	147.5	153	138.9	127½	123.3	102	104.2	76½	85.4
35	87½	210	170.1	175	150.0	157½	142.0	131¼	124.6	105	107.4	78¾	87.5
36	90	216	174.9	180	154.3	162	146.0	135	130.8	108	110.4	81	90.5
37	92½	222	179.8	185	158.6	166½	149.7	138¾	133.0	111	113.5	83¼	93.0
38	95	228	184.6	190	162.9	171	155.5	142½	136.0	114	116.4	85½	95.0
39	97½	234	189.5	195	167.2	175½	157.0	146¼	139.4	117	118.5	87¾	97.0
40	100	240	195.0	200	171.5	180	161.0	150	142.4	120	121.4	90	99.9

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Radiator Ratings—3-Col. Steam, Rating with Shield | No. 14-R

Copies of this Data Sheet, printed separately, 5 cents each.

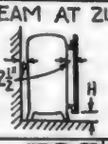
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Four-Column Steam, Rating with Shield

STEAM AT 215°F

4 COLUMN RADIATOR



RATING WITH SHIELD

SECTIONS	LENGTH IN INCHES	45"		38"		32"		26"		22"		18"	
		Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. H=6"
2	6	20	20.4	16	17.2	13	14.6	10	11.9	8	10.3	6	8.3
3	9	30	27.8	24	23.3	19½	19.8	15	16.3	12	14.0	9	11.3
4	12	40	34.9	32	29.4	26	25.1	20	20.6	16	17.7	12	14.3
5	15	50	42.2	40	35.5	32½	30.2	25	24.9	20	21.3	15	17.6
6	18	60	49.7	48	42.2	39	35.6	30	29.4	24	25.0	18	20.6
7	21	70	59.4	56	48.3	45½	41.0	35	33.8	28	29.0	21	23.2
8	24	80	64.9	64	54.8	52	46.4	40	38.4	32	32.7	24	26.7
9	27	90	72.4	72	61.0	58½	51.8	45	42.7	36	36.5	27	29.6
10	30	100	79.6	80	67.3	65	56.9	50	47.0	40	40.0	30	32.7
11	33	110	87.2	88	73.8	71½	62.4	55	51.7	44	43.8	33	36.4
12	36	120	94.6	96	80.2	78	67.7	60	56.1	48	47.6	36	38.8
13	39	130	101.8	104	85.9	84½	73.1	65	60.1	52	51.4	39	41.4
14	42	140	109.8	112	92.6	91	78.8	70	64.9	56	55.2	42	45.0
15	45	150	116.9	120	98.7	97½	83.9	75	69.3	60	58.9	45	48.1
16	48	160	124.2	128	105.0	104	89.2	80	73.8	64	62.5	48	51.0
17	51	170	132.0	136	111.3	110½	94.7	85	78.2	68	66.4	51	54.3
18	54	180	139.0	144	117.5	117	99.7	90	82.6	72	70.2	54	57.1
19	57	190	146.0	152	123.3	123½	104.6	95	86.8	76	73.9	57	59.9
20	60	200	153.7	160	130.3	130	110.4	100	91.2	80	77.6	60	63.0
21	63	210	160.3	168	135.4	136½	115.5	105	95.2	84	81.5	63	66.2
22	66	220	168.2	176	142.1	143	121.1	110	99.6	88	85.2	66	69.2
23	69	230	175.6	184	148.7	149½	126.6	115	104.4	92	89.0	69	72.3
24	72	240	182.5	192	154.2	156	131.4	120	108.3	96	92.0	72	75.4
25	75	250	190.4	200	160.7	162½	136.7	125	112.5	100	96.0	75	78.6
26	78	260	195.5	208	167.3	169	142.5	130	117.2	104	99.9	78	81.6
27	81	270	204.2	216	172.4	175½	146.3	135	121.6	108	103.0	81	84.5
28	84	280	211.0	224	179.0	182	151.6	140	125.5	112	106.6	84	86.8
29	87	290	218.2	232	184.3	188½	156.5	145	130.0	116	110.4	87	90.0
30	90	300	225.0	240	190.0	195	161.6	150	133.9	120	114.0	90	92.6
31	93	310	232.2	248	196.7	201½	166.5	155	138.0	124	117.0	93	95.7
32	96	320	239.7	256	202.8	208	172.9	160	142.7	128	121.8	96	98.6
33	99	330	245.4	264	208.0	214½	177.5	165	146.4	132	124.6	99	101.5
34	102	340	253.2	272	214.1	221	181.9	170	150.6	136	128.4	102	104.6
35	105	350	259.0	280	219.5	227½	187.0	175	154.0	140	131.3	105	107.4
36	108	360	266.8	288	225.9	234	193.1	180	158.2	144	135.0	108	110.5
37	111	370	274.3	296	232.0	240½	197.6	185	163.2	148	138.0	111	113.3
38	114	380	280.3	304	237.0	247	201.2	190	166.5	152	141.6	114	115.3
39	117	390	287.0	312	243.8	253½	207.0	195	171.0	156	145.2	117	118.6
40	120	400	292.7	320	248.0	260	211.5	200	175.7	160	149.0	120	121.5

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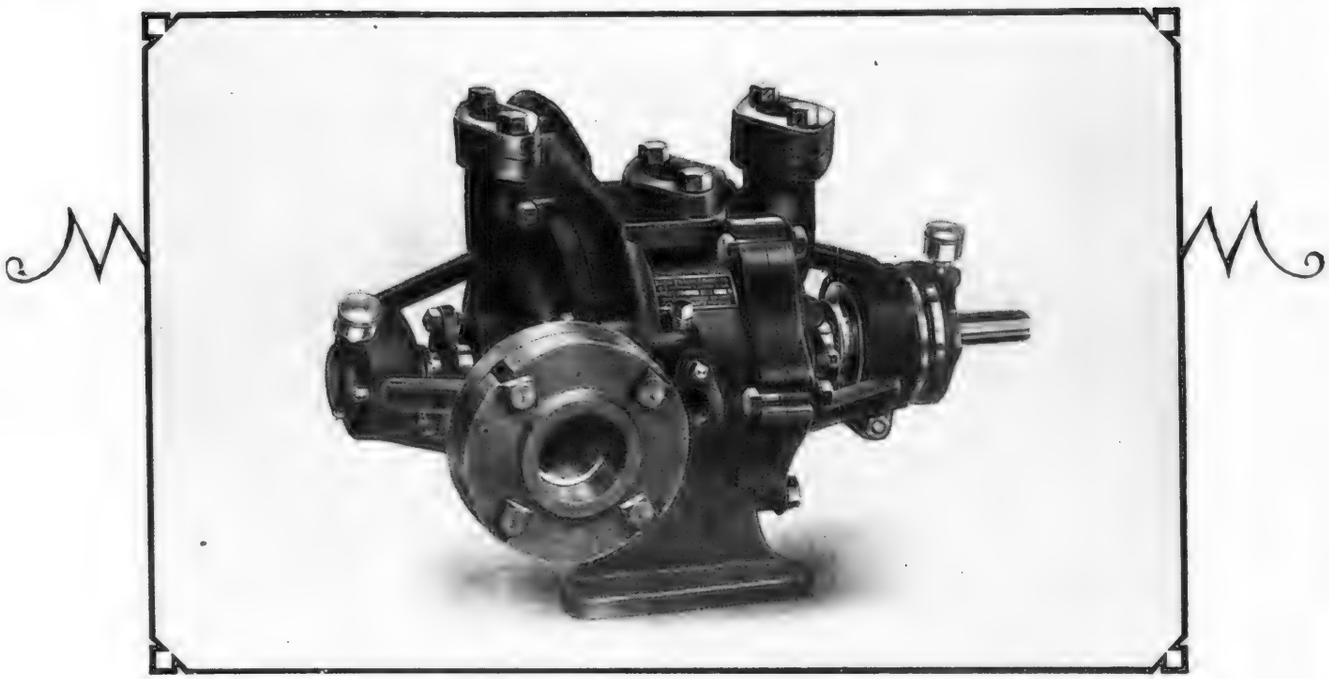
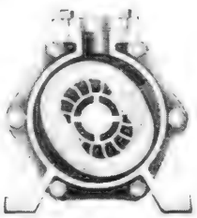
Radiator Ratings—4-Col. Steam, Rating with Shield | No. 14-S

Copies of this Data Sheet, printed separately, 5 cents each.



Jennings Hytor Vacuum Heating Pump, size C, suitable for 26,000 sq. ft. radiation. Only 2 H. P. motor, 1,800 R.P.M., is required when delivering from a vacuum of 10 in. mercury against 10 lbs. boiler working pressure.

The pump you can use with confidence



Sectional View of Jennings Hytor Showing Unique Principle of Operation

The rotor, consisting of a cylindrical hub around the periphery of which are chambers of spaces formed by heavy shrouds cast integrally, revolves freely in an elliptical casing or housing filled with water. As the rotor turns. it carries the water around with it.

The water, under the influence of centrifugal force, is compelled to follow the contour of the casing, and alternately to enter and leave the rotor chambers twice in each revolution.

As the water recedes from the rotor, air is drawn into the chambers through the inlet port. As the water is subsequently forced back into the rotor by the converging casing, the air is compressed and then discharged from the rotor through the outlet port.

Heating engineers, contractors, and others know that many elements are essential in a steam heating system if the best results are to be secured. The boiler must be of proper design, rating, and manufacture, risers and mains should have adequate capacity and be correctly arranged, valves must be suitable for controlling the flow effectively, radiators should be high grade, etc.

But unless efficient means are provided for removing the air and water, and for returning the water to the boiler or hot-well, the overall economy will not be all that it should be. A good vacuum heating pump is essential.

The Jennings Hytor is the kind of pump you can recommend and use with confidence.

It consists of two independent units,—an air pump and a water pump combined in one casing. The impeller of each unit is mounted on the same shaft.

Further, the Jennings Pump is quiet in operation, occupies one-third the space of reciprocating units, and is entirely trustworthy in service. It gives the reliable year-in and year-out performance that engineers prefer and demand.

For complete information write for a copy of Bulletin 15. Also for the praphic device, showing the unique principle of operation of all Jennings Hytors.

NASH ENGINEERING COMPANY

South Norwalk **Connecticut**

Jennings Hytor

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Miscellaneous Notes

R. A. Small, formerly with the Industrial Commission of Wisconsin, announces the termination of his service with that body in order to establish an advisory engineering practice for the assistance of owners, architects and employers interested in compliance with Wisconsin code requirements. His offices are located in Madison, Wis.

Fire Prevention Committee of the Board of Commerce of Detroit met September 25 in conjunction with engineers, oil dealers, oil-burner dealers and others interested in oil-burning equipment, to discuss a proposed ordinance governing the handling, storage and sale of fuel-oil. In addition, the arrangement and installation of oil-burning equipment was taken up in general discussion. Definite action was postponed to a later date.

Southern Chambers of Commerce are the promoters of a Southern Exposition which will be held January 19-31 at the Grand Central Palace, New York. The aim of the exposition will be to "show to the world what the South has done and is accomplishing."

Building Activities declined very slightly in September, according to F. W. Dodge Corporation's monthly statement. The drop from August in 36 eastern States (which include seven-eighths of the total construction volume of the country) was only 3%, which is less than the usual seasonal fluctuation. September building contracts aggregated $344,316,300, an increase of 19% over last September. Of the total, 42% went for residences; 15% for public works; 13% for commercial buildings; 10% for industrial and 9% for educational buildings.

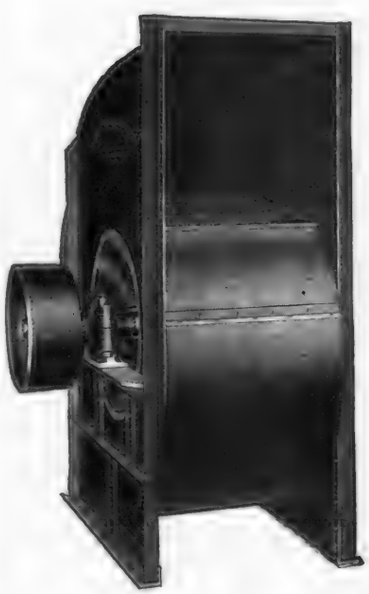
American Institute of Chemical Engineers will hold its next meeting December 3-6, 1924, at Pittsburgh. The summer meeting will be held at Providence, R. I., June 22-27, 1925. Following this latter convention, plans are being made for a trip to England where a joint meeting will be held with the British Institution of Chemical Engineers.

Warm-Air Heating and Sheet Metal Journal has changed its name to *National Sheet Metal Contractor*. The publication will continue to be the official organ of the National Association of Sheet-Metal Contractors.

Chamber of Commerce of the United States in a recent bulletin announce a decided increase in the quantity of American exports covering the period from January to June. The bulletin states that pipes and pipe fittings were in a measure responsible for this increase. During the same period of 1923 the United States exported $12,-164,000 of pipes and pipe fittings, while in the first half of this year, exports in those products amounted to $16,199,000; an increase in value of 33%. Imports in these commodities increased 990%, computed over the same two periods.

Carnegie Institute of Technology announces an exhibit of heating, plumbing and ventilating apparatus as an additional feature of the three-day institute of lectures on November 12-14, for Pennsylvania engineers. The matter of publishing the lectures after the meeting is now under consideration. Among the lectures of interest to heating and ventilating men are: "The Nature of Heat" and "Heat Transfer," both by Professor Harry S. Hower; "Hot Water Demonstrations and Storage of Hot Water" by Professor Samuel E. Dibble; and "Water Pressure," "Flow of Water in Pipes" and

EFFICIENT VENTILATION DEMANDS UNIBLADE BLOWERS



The increasing favor accorded Uniblade Blowers clearly indicates the satisfactory work done by them on hundreds of installations in factories, industrial plants, theatres, schools and public buildings of every nature.

Quietly handling the required amount of air, it is no wonder they are daily specified on the particular jobs where dependable equipment is required.

On your next job be sure of results--specify Uniblade Blowers.

ACTIVE SALES OFFICES AND AGENCIES IN ALL PRINCIPAL CITIES

AUTOVENT FAN & BLOWER CO.
DEPT. "H"
730-738 W. MONROE ST. CHICAGO

"Measurement of Flowing Water" by Professor Harold A. Thomas.

American Red Cross Roll Call, which opened a drive November 11, Armistice Day, for funds to maintain the organization relief work and public health program, has appointed a Boilers, Engineers and Machinery Group under the chairmanship of C. P. Coleman, president of the Worthington Pump Company. There has also been named a Heating and Piping Group and a Plumbing and Piping Group. Aid for the ex-service man and his dependents constitutes the major part of the Red Cross program in New York.

Last year, more than $39,400 was expended in this work which includes legal assistance, money loans and medical attention, and a total of 4500 cases were handled. The Red Cross's outstanding metropolis activities are the disaster relief and public health programs under which more than 600,000 surgical dressings were supplied within the twelve months to sixteen local hospitals, in addition to nursing service, first aid and work in home hygiene and care of the sick.

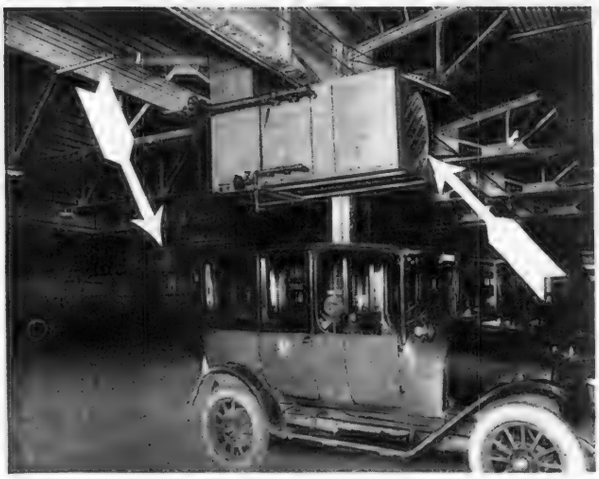
National Warm-Air Heating and Ventilating Association has issued formal notice of the forthcoming meeting of the association, in Urbana, Ill., December 2 and 3, next, when the association's Heating Research Residence will be dedicated. Other features of the meeting will be a report on research work conducted since the April convention. Headquarters will be at the Urbana-Lincoln Hotel, Urbana.

Third National Exposition of Power and Mechanical Engineering, better known as the "Power Show," will go on at the Grand Central Palace, December 1-6. Other forthcoming shows at the Grand Central Palace, of interest to heating men, are the Architectural and Allied Arts Exposition, April 20, May 2, 1925, and the Southern Exposition, January 19-31, 1925.

New York.—The marriage is announced of Edwin A. Scott, president of the E. A. Scott Publishing Co., publishers of *Sheet Metal Worker* and *Sanitary and Heating Engineering*, with Miss Gertrude I. Lyons, in New

The Garage Owner Is Interested in More Heat For Less Money

Built for placing on the floor or suspended from the ceiling. Furnished with Vento or Aerofin Heating Coils.



Ilgair Unit Heaters can be connected to the outside for introducing fresh warm air. Note by-pass connection in the picture.

No other active industry has as acute heating problems as confront the garage man. He is paying for heating two thirds of the space that is never used. He also needs fresh air to replace and force out automobile engine exhaust gases.

Ilgair Unit Heaters are scientifically adaptable for this purpose. Send for Circular.

HIGH EFFICIENCY ILG VENTILATING MACHINERY

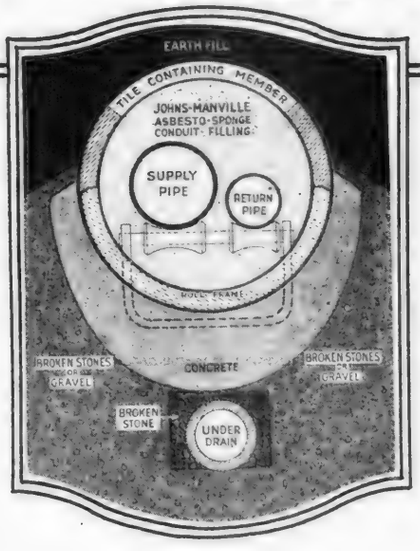
Ventilation

FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO. 2858 NORTH CRAWFORD AVE. CHICAGO

BRANCHES IN ALL PRINCIPAL CITIES

EFFICIENCY 90% OR GREATER



WE guarantee at least 90% efficiency for the Johns-Manville Underground System of Insulation—but that is conservative. Actually the efficiency averages well above this figure.

For instance, at Cornell University where over 19,000 ft. of this system is in use, the actual loss on a tested 5,000 ft. portion of the system was 27.7% lower than the loss allowed by the guarantee.

On the tested portion alone, this extra efficiency represents an *additional* saving of 85 tons of coal per year for the University. This system has operated two years with complete satisfaction.

Asbestos
INSULATION
BRAKE LININGS
ROOFINGS
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FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE Inc., 292 Madison Ave., at 41st St., N. Y. C.
Branches in 62 Large Cities
For Canada: CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

JOHNS-MANVILLE
Underground System of Insulation

York, October 11. Mr. and Mrs. Scott spent their honeymoon in Havana, Cuba.

Eastern Supply Association, at its annual meeting in New York, October 8, elected George Keenan, president of the Bayonne Supply Co., of Bayonne, N. J., as president of the association. Other officers elected are: first vice-president, P. F. Faherty; second vice-president, Rubin Tate; treasurer, Martin Behrer; secretary, Frank S. Hanley. A significant address on "What Is Wrong?" by Dixon C. Williams, president of the Chicago Nipple Mfg. Co., included a plea for a revival of the old spirit of honesty in business dealings, the speaker declaring that price slaughtering had become an art. As a result men were becoming suspicious of each other and it was high time to take a firm stand against evil practices in business. John J. O'Connor, manager of the finance department of the Chamber of Commerce of the United States, spoke on "Progress Under the Dawes Plan," showing how the rehabilitation of Europe would benefit this country. J. H. Tregoe, executive manager of the National Association of Credit Men of the United States, explained the plan adopted by that body to deal with commercial crime. In a round table discussion of prevailing business conditions the consensus of opinion was that conditions were slightly improved, with few fluctuations in prices. After the officers were installed, William J. Woolley, secretary-manager of the National Trade Extension Bureau, gave some interesting details of the survey now being made by the Department of Commerce, in Washington, of the needs of the homes of the country in the way of plumbing equipment.

New York.—The retirement from business of George H. Morris, of the heating contracting firm of Johnson & Morris, is made the occasion of a tribute to him in the current issue of the *Official Bulletin* of the Heating and Piping Contractors' National Association. In the review of his career details are given of his activities in connection with the dealings of the employers with the striking journeymen which led to the formation of the New York City Association of Master Steam and Hot Water Fitters, in 1885. His important work, later on, as presiding officer of the General Board of Arbitration of the Building Trades of New York City, is recalled, including the unique distinction held by Mr. Morris, of having been selected to that office not only by the employers, when it was their turn to name the chairman, but by the journeymen when the selection was in their hands. A testimonial dinner was tendered Mr. Morris by some of his older business acquaintances and office associates, September 11, at the Waldorf Hotel.

American Welding Society held its annual meeting October 30-31, in Cleveland, at the Hotel Winton. Among the inspection trips was one to the National Tube Company's plant at Lorain. The technical sessions were devoted to a number of papers on the general subject of applications of welding in the construction of bridges, buildings, etc. It was brought out that a great deal of information is needed which will require elaborate and costly investigations. Among the plans for extending the use of welding, it is proposed to summarize in useable form results obtained in service where welding has already been used, to furnish engineers, designers and draftsmen with accurate data as to costs, methods to be used, engineering data as to types of joints, strength to be expected and factors of safety. In addition, it will be necessary to convince legislators that welding is safe and adequate for the purpose intended. The next step will be to show engineers and contractors how to go about the adjusting of their fabricating and shop methods so that the work can be satisfactorily and economically performed.

National Industrial Conference Board reports, under date of October 23, that everything points to a slow but steady improvement in industry. The latest survey of wages, hours and employment in 23 leading manufacturing industries, covering the month of August, shows a definite upward tendency in the number employed and in the average hours of work per wage earner. It is a remarkable fact, states the report, that in spite of an industrial depression of some severity, with very few exceptions wage rates have maintained the high levels which were reached in the boom period of last year. Further evidence that industrial conditions are improving is found in a summary of wage changes throughout the United States during the month ending October 14, made by the board, which reveals forty increases and six reductions.

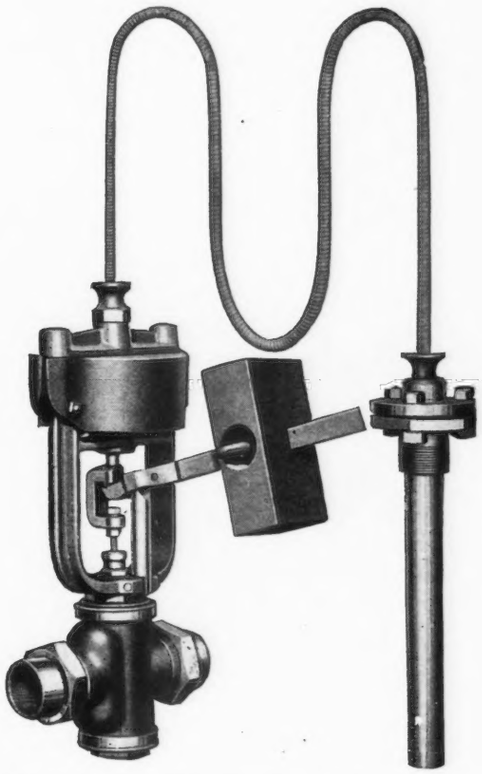
Kewanee, Ill.—Baker Park, the newest park in Kewanee, Ill., which was opened recently, is so named in honor of E. E. Baker, president of the Kewanee Boiler Company. Mr. Baker has taken great interest in the city's parks and of the $150,000 so far expended in developing the new park, Mr. Baker has contributed $50,000. In addition Mr. Baker has borne one-half of the cost of grading and planting which will come to nearly $35,000. He has also set aside the sum of $100,000 the interest on which is to be used for the maintenance of the park.

Central Supply Association held its thirtieth annual meeting at the Drake Hotel, Chicago, October 22-23. Among the speakers at the opening session were Former Secretary of Agriculture Edward T. Meredith, of Des Moines, Ia., who spoke on "Agriculture and Industry," and William J. Woolley, secretary-manager of the National Trade Extension Bureau, who emphasized the need of more apprentices to increase the number of workers in the installation end of the business. As he stated, while we may manufacture and sell supplies, unless the men are at hand to suitably install them, business will surely recede. At the afternoon session, talks by members were presented, the speakers including M. M. Cochran, J. M. McDonald and Charles K. Foster.

Speakers at the Thursday morning session included President John J. Vogelpohl, of the National Association of Master Plumbers, who told of the work done in the way of standardization of plumbing.

MANUFACTURED WEATHER
makes
"Every day a good day"
Humidification · Dehumidification
Heating · Ventilation · Purification
Drying
Carrier
Engineering Corporation
750 Frelinghuysen Ave. Newark, N. J.
Boston Buffalo Chicago New York Philadelphia Los Angeles
SEE OUR DETAILED DATA IN ASH&VE GUIDE
SEE OUR DETAILED DATA IN ASH&VE GUIDE

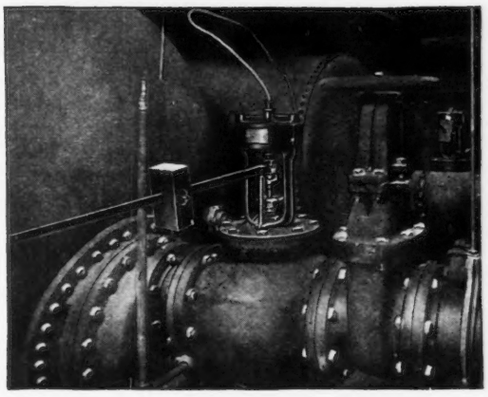
(At right) A very clear illustration of the Cortland Normal School installation. Two No. 930 lever type Sylphon Temperature Regulators were used. The picture shows the valve in the steam line and the bulb (at the end of the flexible tube) is in the tank.



This is the instrument complete. No air lines, water lines, drips, electric currents. All you have to fuss with is right here in the picture.

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL, SEAMLESS SYLPHON BELLOWS
Sylphon

This diagrammatic cut shows the extreme flexibility of the famous Sylphon bellows. In the head of the instrument, it is one of the 3 reasons why architects and engineers specify Sylphon Temperature Regulators, calling for them by name.



When the heating contractor installed these 2 Sylphon hot-water Regulators—

he knew the State Normal School could *absolutely rely* on them.

It was a clean job, too, with the profits on it "his for keeps"—no trouble-shooter's time to be paid out of profits in a few weeks, or months.

The 3 big profit making advantages that are built into **every** Sylphon Temperature Regulator are sensitiveness and accuracy of control, and long life. These 3 are guaranteed because we use as our expansion member the famous Sylphon bellows.

This bellows, drawn from a flat sheet of metal, without soldered seam, is the most powerful and flexible expansion member known. Its use makes possible a self-contained instrument, one that generates within itself the power for operating the valve in the steam line, without **any** auxiliary aid.

Add to these distinct advantages the fact that these sturdy, accurate instruments are sold direct to the heating trade through over 30 national sales offices, and unrestricted service is given at any point in the U. S., and you have the reasons why thousands of heating men are sold solid to Sylphon Regulators and The Fulton Company service.

Sylphon TEMPERATURE REGULATORS *for Liquids—for Air*

THE FULTON COMPANY KNOXVILLE, TENN.

New York Chicago Detroit Boston Philadelphia *Representatives in all principal cities in U. S.*
European representatives: Crosby Valve & Engineering Co., Ltd., 41–42 Foley Street, London, W. I., England
Canadian representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

A feeling of optimism pervaded the meeting and it was felt not only that prosperous conditions would continue but, with a settled political situation, the country would go forward to larger success.

When the time came for the election of officers Secretary Paul Blatchford made the request that his name be not considered for re-election. He felt, he stated, that after a service of 24 years to the organization, he had earned his retirement. C. V. Kellogg expressed to the retiring secretary the sentiments of the organization indicating their appreciation of his long service. Subsequently the members of the association conferred upon Mr. Blatchford the office of honorary president during life. The only time this title had been previously conferred was upon the association's first president, John F. Wolff.

The new officers are: President, F. R. Dengel, F. R. Dengel Mfg. Co., Milwaukee, Wis.; first vice-president, J. D. Tschopik, Standard Sanitary Mfg. Co., Pittsburgh; second vice-president, M. M. Cochran, Cochran-Sargent Co., St. Paul, Minn.; treasurer, C. V. Kellogg, Kellogg-Mackay Co., Chicago; secretary, W. E. McCullum, 139 North Clark St., Chicago; executive committee: F. R. Dengel, J. D. Tschopik, M. M. Cochran, C. V. Kellogg, L. J. Merkel, The Merkel Bros. Co., Cincinnati; F. N. Kretschmer, Kretschmer Mfg. Co., Dubuque, Ia.; Isidor Weil, Weil-McLain Co., Chicago; Edward F. Niedecken, Hoffman & Billings Mfg. Co., Milwaukee; and M. J. O'Fallon, M. J. O'Fallon Supply Co., Denver.

Manufacturers' Notes

Nye Tool & Machine Works, Chicago, Ill., has completed its new factory on Fullerton Avenue, near Crawford, Chicago. The new plant occupies about one-half of the site purchased by the company, provision being made for future expansion. The buildings is of steel and tile construction.

Kewanee Boiler Co., Kewanee, Ill., has opened a Boston office at 555 Little Building, 80 Boylston Street. Raymond Newcomb is in charge.

E. F. Keating Co., New York, jobbers of pipe and other heating and power supplies, has opened an uptown office at 25 West 43rd Street, New York, under the management of W. P. Amick. The company has recently taken over the agency for the metropolitan district of the products of the Keating Valve Co., Inc., of Springfield, Mass.

Utica Heater Co., Utica, N. Y., has appointed H. R. Dillon associate sales manager, with headquarters in Utica. Mr. Dillon was previously connected with the company's New York office.

Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Pa., has appointed Harold S. Hall as manager of its new sprinkler equipment and factory heating department. Mr. Hall was formerly with the Grinnell Company and General Fire Extinguisher Company.

Hoffman Specialty Co., reports an increase of 22% in sales for the third quarter of this year over the year 1923. The outlook for the balance of the season it is reported, is very favorable.

EverHot Heater Co., Detroit, Mich., has been authorized to increase its capital stock from $200,000 to $400,000. Present stockholders of the company have purchased the entire additional issue.

Trane Co.'s New York Branch, 15 Park Row, New York City, has added C. G. Kansenbrock to its staff to help serve the Manhattan trade and Frank Glanz for similar service in New Jersey. M. William Ehrlich, engineer in charge, reports satisfactory business conditions.

International Heater Co., Utica, N. Y., announces the establishment of a branch office and warehouse in Detroit, Mich., at 3962 Cass Avenue. This branch is under the management of Frank E. Farrar, a Detroit heating engineer. The full line of the International Heater Company, including International boilers, warm-air furnaces, one-pipe heaters and Lincoln radiation is now stocked in Detroit.

Universal Smokeless Boiler Co., Ravenna, Ill., has increased its capital

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools
Engineers—New York Board of Education.
Contractors—Federal Heating Co., New York City

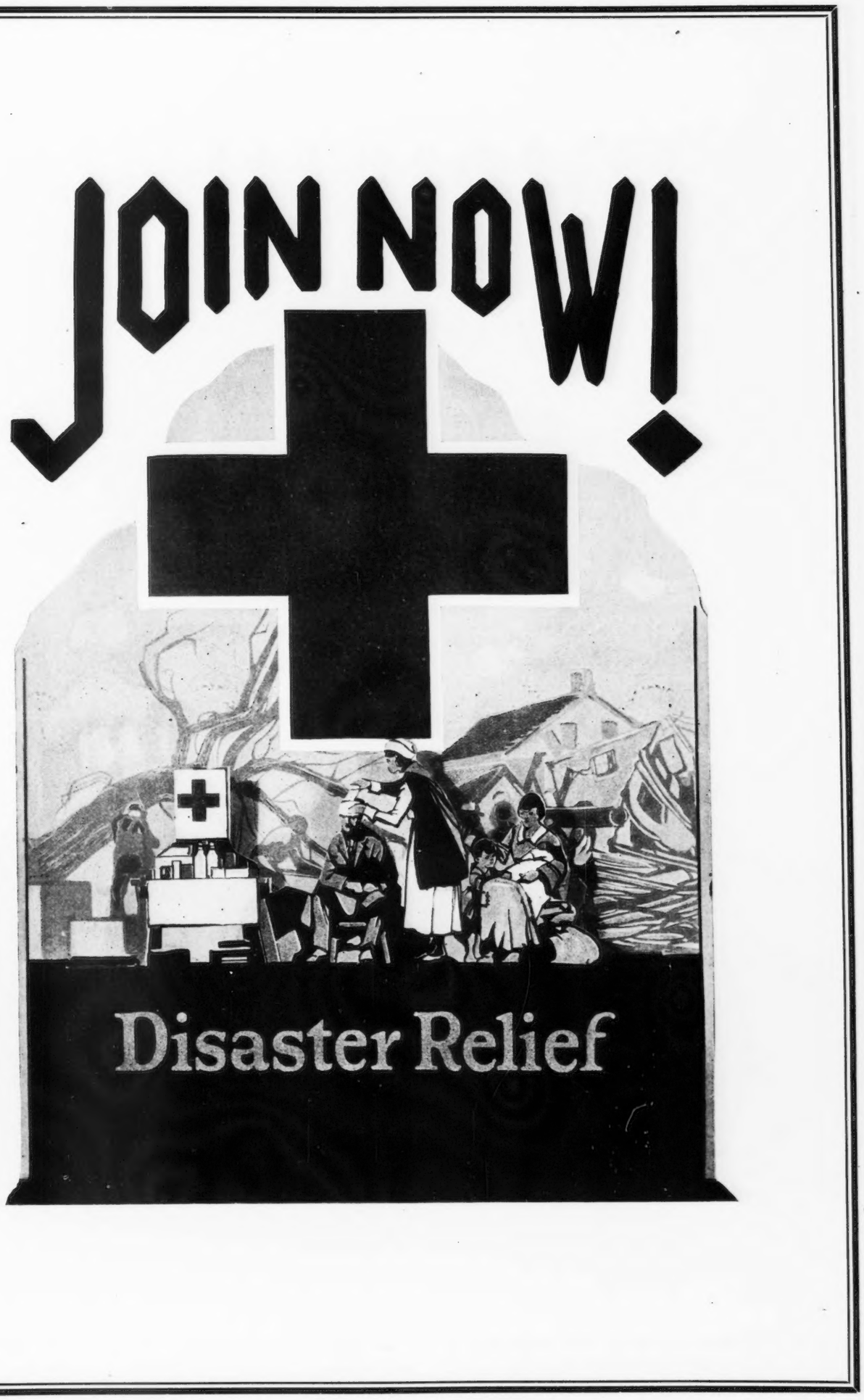
LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior to, any other fans on the market.

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.


JOIN NOW!
Disaster Relief

Window Display Featuring New Arcola Heater

stock from $150,000 to $200,000, by issuing $50,000 of 8% preferred stock. The company was incorporated in 1917 and located in Ravenna two years ago. The company has recently added to its line a small type of boiler for house use.

A New Arcola Heater

Arcola Week sales drive, conducted annually by the American Radiator Company, and carried out this year during the week of October 20, was made the occasion of a public announcement by the company of the New Arcola heating outfit. This heater was made the feature of the window display material which appeared in the show-rooms of qualified dealers, linking up the company's national advertising with the dealer's place of business.

The display consisted of two large background screens showing a typical American town in winter. Cut-out sections of the houses revealed various heating products installed. The center of attention was held by a life-sized cardboard cut-out of the New Arcola.

During the previous two months American Radiator Company's salesmen were engaged in enrolling Arcola merchants in every town, especially in every county seat, so that anyone interested through reading the company's national advertising would have no difficulty in finding a local dealer.

The new Arcola is a companion to the present model, and each may be used with or without a cellar, hot water being the heating medium. Manufacture of the Ideal Arcola, it is announced, will be continued. The heating surface in the New Arcola has been increased and a number of improvements added. Regulation has been provided for by inserting a sensitive bellows-type regulator in the back section over the hot spot in the fire. A large lock-safe fire door, fitted with Pyrex glass panels, has been added so that the cheerful glow of the fire is visible. A vitreous enamel cover of pearl gray furnishes a pleasing contrast to the black enameled doors. The New Arcola is sold complete with trimmings, such as altitude gauge, thermometer and automatic regulator.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

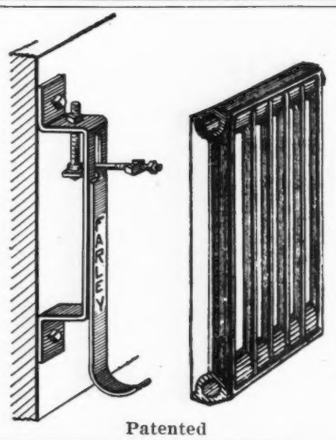
ENGINEER WANTED—Heating and ventilating engineer wanted for large corporation. Must have experience and ability to specify and design factory heating and ventilating equipment. In reply state experience in detail, references and salary required. Address Box 104, care of Heating and Ventilating Magazine.

POSITION WANTED—Position wanted by accurate estimator and designer on heating, ventilating and power piping work, capable of taking charge of a department, or acting as sales engineer. Address Box 112, care of Heating and Ventilating Magazine.

POSITION WANTED—Position wanted by estimator experienced in estimating on large contracts of heating, ventilation and power piping. Address 113, care of Heating and Ventilating Magazine.

REPRESENTATIVE WANTED.—Representative wanted to handle ventilating equipment made by western manufacturer specializing in propeller fans and multivane volume blowers; propeller fans made in sizes from 12 in. to 72 in., blowers from 10 in. to 150 in. This connection to be on a strictly commission basis. Address Box 114, care of Heating and Ventilating Magazine.

POSITION WANTED.—Young engineer, age 24, technical graduate, three years' experience in heating and ventilating estimating, designing and specification work, desires connection with reliable contractor or in architect's office. Address Box 116, care of Heating and Ventilating Magazine.



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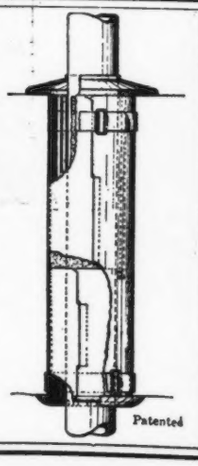
Hangers *and* Sleeves

This is the hanger you are looking for, made of hot rolled steel, will not break and made to fit any style of your radiation.

Fire resisting "Grab-on" sleeves are used in all classes of buildings. They are made to fit the condition of construction of the building. The only sleeve that will hold covering against the ceiling.



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